Technical Documentation

Hand-held Analyzer Types 2250 and 2270

With Sound Level Meter Software BZ-7222,
Frequency Analysis Software BZ-7223,
Logging Software BZ-7224,
Enhanced Logging Software BZ-7225,
Signal Recording Option BZ-7226,
Reverberation Time Software BZ-7227,
2-channel Option BZ-7229
Tone Assessment Option BZ-7231 and
Low Frequency Option BZ-7234

User Manual

Brüel & Kjær

English BE 1713 – 30

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Low Frequency Option BZ-7234

User Manual

Valid for all hardware versions and from software version 4.4

BE 1713–30

2015

Safety Considerations

This apparatus has been designed and tested in accordance with EN/IEC 61010 – 1 and ANSI/UL 61010 – 1 *Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use*. This manual contains information and warnings which must be followed to ensure safe operation and to retain the apparatus in safe condition. Special note should be made of the following:

Safety Symbols

The apparatus will be marked with this symbol when it is important that you refer to the associated warning statements given in the manual.

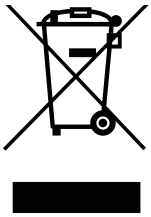
Protective Earth Terminal Hazardous Voltage

Explosion Hazard

The equipment is not designed to be used in potentially explosive environments. It should not be operated in the presence of flammable liquids or gases.

Warnings

- Switch off all power to equipment before connecting or disconnecting their digital interface. Failure to do so could damage the equipment.
- Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, it must be made inoperative and be secured against unintended operation.
- Any adjustment, maintenance and repair of the open apparatus under voltage must be avoided as far as possible and, if unavoidable, must be carried out only by trained service personnel.



- Do not dispose of electronic equipment or batteries as unsorted municipal waste
- It is your responsibility to contribute to a clean and healthy environment by using the appropriate local return and collection systems
- Hazardous substances in electronic equipment or batteries may have detrimental effects on the environment and human health
- The symbol shown to the left indicates that separate collection systems must be used for any discarded equipment or batteries marked with that symbol
- Waste electrical and electronic equipment or batteries may be returned to your local Brüel & Kjær representative or to Brüel & Kjær Headquarters for disposal

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Chapter 1

Introduction

1.1 Welcome

This manual describes Type 2250 Hand-held Analyzer and Type 2270 Hand-held Analyzer platforms, including:

- Sound Level Meter Software BZ-7222
- Frequency Analysis Software BZ-7223
- Logging Software BZ-7224
- Enhanced Logging Software BZ-7225
- Signal Recording Option BZ-7226
- Reverberation Time Software BZ-7227
- 2-channel Option BZ-7229
- Tone Assessment Option BZ-7231
- Low Frequency Option BZ-7234

The manual explains how to perform a basic sound measurement, which parameters you can measure and how the hand-held analyzer should be operated. In addition, some practical hints and guidelines are provided, including all relevant technical specifications. Finally, a glossary is added to help with specific terminology found in this manual.

This manual is intended for all hardware versions (from 1 to 4). All hardware versions support the latest application software covered in this manual.

1.2 How to Use this Manual

1.2.1 Conventions Used in this Manual

“Analyzer” refers to Type 2250 or Type 2270 if the description is valid for both types.

Instructions and descriptions that refer to the analyzer pushbuttons are shown with the pushbutton icons as seen on the analyzer. See Chapter 2 for a list of pushbutton icons and their functions.

Icons, Buttons and Tabs Used on the Screen

Indicated by bold type face (for example, tap the **Main Menu** icon).

Parameter Text Appearing on the Screen

Parameters, instructions and descriptions appearing on the screen are indicated by italics (for example, *Measurement Mode*).

Path Denotations

Indicated by capitals (for example, SETUP\BZ7222\).

Menu/Screen Navigation

Indicated by italics (for example, *Setup > Frequency Settings > BB Peak*).

1.2.2 Beginners

Before you read the rest of this manual, read Brüel & Kjær's primer on Measuring Sound. This will give you a basic idea of acoustic measurements. It can be found on the www.bksv.com website, by typing 'Primer' in the search window. The website also contains lots of other information you might find useful.

Further information is available in the online help installed on the analyzer.

1.2.3 Experienced Users of Acoustic Measurement Equipment

The manual is designed so that you don't have to read all of it to be able to use the analyzer. It is built around the most frequently used operations, these are as follows:

- Assembling your Analyzer (see Chapter 2)
- Making your First Measurement (see Chapter 3)
- Calibration (see Chapter 5)
- Getting to Know Your Analyzer (see Chapter 4)
- Data Management (see Chapter 6)
- Connection to PC or Smart Phone (see Chapter 7)
- Advanced Use of the Analyzer – Tips and Tricks (see Chapter 8)
- Updating and Upgrading Applications, Maintenance and Troubleshooting (see Chapter 9)

However, it is recommended that you read the entire manual for appropriate procedures on how to use the analyzer to obtain accurate sound level measurement results.

Chapter 2

Assembling your Analyzer

This chapter describes how to assemble and set up your analyzer. It provides a brief description and an associated diagram showing the analyzer components and the various input and output connections. This enables you to start getting familiar with the analyzer, while assembling your system.

This is followed by an overview of the hardware components, showing all the main configurations of the analyzer and its accessories.

Finally, instructions are provided that explain how to assemble standard and optional hardware components used in your system. Once you have followed the assembly instructions, your hand-held analyzer will be ready to make measurements.

2.1 Determining Your Hardware Version

Over the years, the analyzer hardware has had a few updates. The most significant update happened in 2012 with the introduction of hardware version 4 (also known as G4). To check if your analyzer uses G4 hardware, click ? in the Shortcut Bar at the bottom of the display screen, and select *About*. The About screen will list the hardware and software versions currently installed.

2.1.1 What is Different with G4 Hardware?

The differences in the G4 hardware compared to previous versions include:

- A brighter screen which is easier to view in direct sunlight
- The CF card slot is removed and replaced by a second SD card slot to take advantage of the SD format's dominance in the storage and Wi-Fi markets
- The USB connector changed from USB 1.1 Mini B to USB 2.0 Micro AB. Besides the faster connection speeds of USB 2.0, the Micro USB connector is more common
- A second standard USB Type A socket was added for easier connection to USB peripherals like modems, printers, GPS receivers, and USB to RS−232 adaptors
- A 100 Mbps LAN connector is available for both Types 2250 and 2270

2.2 Analyzer Components

An overview of the main analyzer components is provided in Fig. 2.1 and the text below.

Fig. 2.1 *Analyzer components*

1) **Measurement Microphone:** A Brüel & Kjær Prepolarized Free-field ½″ Microphone is used. A robust and reliable microphone with a wide frequency range.

2) **Preamplifier:** Used to convert the high-impedance output of the microphone to low impedance, suitable for driving long extension cables. The arrow points to the preamplifier's built-in windscreen sensor

3) **(Manual Event Pushbutton):** This allows you to manually indicate events during a measurement. Using BZ-7222 and BZ-7223 software you can control signal recording (this requires a license for the BZ-7226 option), and using BZ-7224 Logging Software or BZ-7225 Enhanced Logging Software you can insert an Event Marker and control recordings (the latter requires a license for the BZ-7226 option). In Type 2270 this button can also be used to capture images.

4) **(Commentary Pushbutton):** This allows you to add recorded audio messages to your measurement files.

5) ▲, ▼, ◄, ► **(Navigation Pushbuttons):** These move the active screen component (Field Selector) and navigate the user interface.

6) **(Back-erase Pushbutton):** This allows you to erase the last 5 seconds of measurement data or to insert an Exclude Marker (BZ-7224 Logging Software or BZ-7225 Enhanced Logging Software only).

7) **(Accept Pushbutton):** This allows you to accept any changes you make to the analyzer's setup.

8) **(Reset Measurement Pushbutton):** This allows you clear the current measurement from the screen.

9) **(Start/Pause/Continue Pushbutton):** Press this to start, pause or continue with a measurement.

10) **(Status Indicator):** The red, yellow or green lights, (or LEDs), referred to as the 'Traffic Light' either side of the **Start/Pause** pushbutton, indicate important states of the analyzer during operation, that is, measurement stopped, paused or running. See Chapter 4 for further details.

11) **(Save Pushbutton):** This allows you to save measurement results.

12) **Display Screen:** A high-contrast, colour, touch-sensitive screen.

13) **(Main Menu Icon):** This calls up the Main Menu, which allows you to navigate immediately to all the main functions of the analyzer, such as Setup, Explorer (or Data-browser), Preferences, and the Calibration procedure.

14) **(Power-on Pushbutton):** Turns the analyzer on and off. If held in for 1 second, the analyzer goes into standby mode; if held in for more than 4 seconds, it turns the analyzer off.

15) **Stylus:** Stored in a holder on the side of the analyzer, for use on the touch-sensitive screen. You can choose to use the stylus or the hardkeys, depending on your preference and the measurement situation. (Also see section 4.4.5.)

16) **Secondary Microphone:** This is used to add recorded comments to measurements and is positioned on the underside of the analyzer.

17) **Top Socket:** This is the main microphone input socket for the analyzer. The measurement microphone and preamplifier (items 1 and 2 respectively) are normally connected directly to this socket. For more details see section 2.3.

18) **Tripod Mounting Thread:** Use this to mount the analyzer onto the tripod and/or tripod extension.

19) **Wrist Strap/Tripod Mounting Thread:** Use this to attach the wrist strap to the analyzer for added security, or use it to mount the analyzer onto the tripod and/or tripod extension using Tripod Adaptor UA-1673.

20) **Internal Battery Pack:** Rechargeable, high-capacity Li-Ion battery pack to power the analyzer.

21) **Hinged Cover FB-0679/FB-0699:** A removable plastic cover is provided, which is hinged at the top to provide protection for the connector panel underneath. To remove, open the cover and pull the hinge out of the slot at the top of the connector panel. The cover includes a rubber insert printed with an overview of the main connectors and reset button for easy recognition. Indents are provided on the inside of the cover (behind the insert) that allow you to drill holes in the plastic cover, giving access to the main connectors underneath, so you can use the cover while power or other cables are connected.

22) **Camera (Type 2270 only):** This feature is used to add images to measurements. Protected and positioned on the underside at 45 degrees, this is designed to allow simultaneous image capture and noise measurement without the need to reposition the analyzer for each task.

23) **High Speed USB and LAN Interfaces:**
   - Hardware versions 1 – 3: Available in Type 2270 only
   - Hardware version 4 (G4): Available in both Types 2250 and 2270

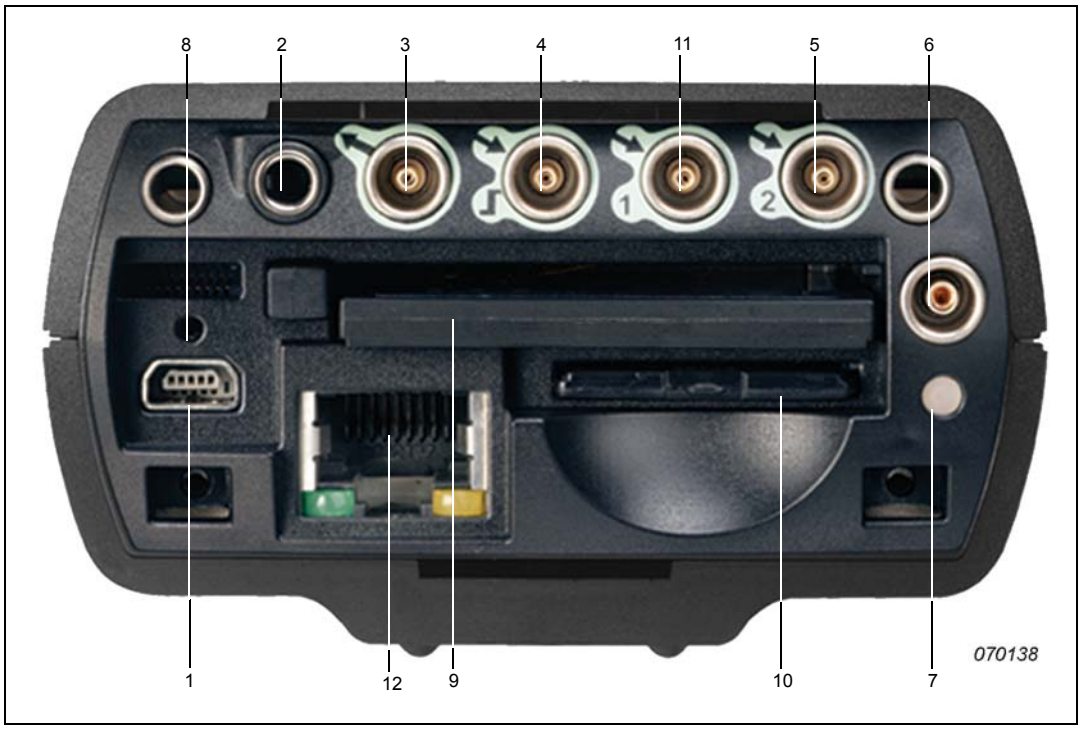
   This is used to provide fast and seamless transfer of data, recordings and photographs back to the office. Both high-speed interfaces, USB or LAN, can be used when the analyzer is located in close proximity to the PC. However, if the analyzer is remote from the host PC, the LAN interface has the further advantage of data download from anywhere within the same LAN network. Both interfaces are not just used for data download, but also for remote monitoring and remote control.

24) **G4 Mark:** Indicates that the hardware is version 4. Without this mark, your hardware is an earlier version

2.3 Analyzer Inputs/Outputs

Hardware Versions 1 – 3:

Fig.2.2 *Connector panel of Type 2270 with hardware versions 1 – 3*



1) **Mini USB Interface Socket:** Use the supplied Mini USB Cable AO-1476 to connect.

2) **Earphone Socket:** Use the supplied Earphones HT-0015 to connect

3) **Output Socket:** A triaxial LEMO connector – use the supplied LEMO to BNC cable AO-0440-D-015 to connect

4) **Trigger and Tacho Input Socket:** A triaxial LEMO connector – use the supplied LEMO to BNC cable AO-0440-D-015 to connect. For tacho probe connection, other cables may be used – see section 2.3.1 for more information

5) **Input Socket (or for Type 2270 only, Input Ch.2 Socket):** A triaxial LEMO connector –depending on the transducer used, a number of cables are available for connection. See section 2.3.1 for more information

6) **External Power Socket:** Use Mains Power Supply ZG-0426 to connect and charge batteries

7) **Battery Charge Indicator:** An LED that indicates when the battery pack is being charged from external power. See section 2.3.1 for more information on the LED colour codes

8) **Reset Button:** Press to reset the analyzer if you have problems

9) **Compact Flash Card Slot:** Insert a CF memory card to save data or connect a modem (either a compact flash modem or using an CF to Serial converter)

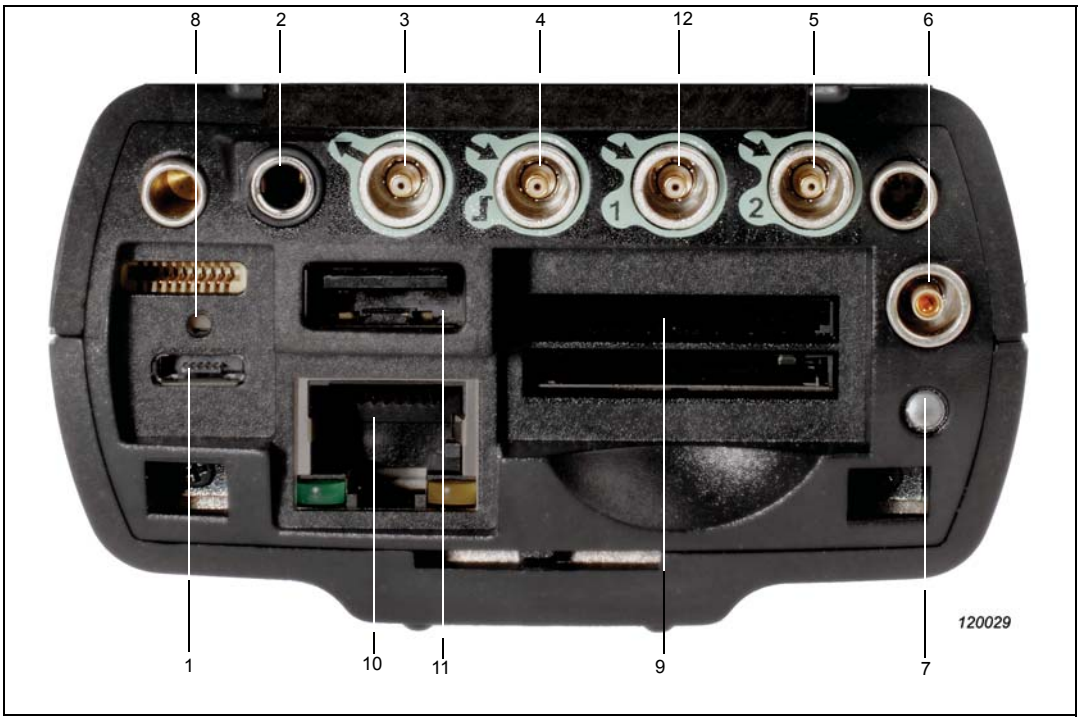
10) **Secure Digital Card Slot:** Insert a SD or SDHC memory card to save data

11) (Type 2270 only) **Input Ch.1 Socket:** A triaxial LEMO connector – depending on the transducer used, a number of cables are available for connection. See section 2.3.1 for more information

12) (Type 2270 only) **LAN Socket:** Connect a LAN cable to synchronise measurement and setup data with a host PC over a Local Area Network

Hardware Version 4:

Fig.2.3 *Connector panel of Type 2270 for G4 hardware*



1) **Micro USB Interface Socket:** Use the supplied Micro USB Cable AO-1494 to connect

2) **Earphone Socket:** Use the supplied Earphones HT-0015 to connect

3) **Output Socket:** A triaxial LEMO connector – use the supplied LEMO to BNC cable AO-0440-D-015 to connect

4) **Trigger and Tacho Input Socket:** A triaxial LEMO connector – use the supplied LEMO to BNC cable AO-0440-D-015 to connect. For tacho probe connection, other cables may be used – see section 2.3.1 for more information

5) **Input Socket (or for Type 2270 only: Input Ch.2 Socket):** A triaxial LEMO connector –depending on the transducer used, a number of cables are available for connection. See section 2.3.1 for more information

6) **External Power Socket:** Use Mains Power Supply ZG-0426 to connect and charge batteries

7) **Battery Charge Indicator:** An LED that indicates when the battery pack is being charged from external power. See section 2.3.1 for more information on the LED colour codes

8) **Reset Button:** Press to reset the analyzer if you have problems

9) **Secure Digital Card Slots** Insert a SD or SDHC memory card to save data

10) **LAN Socket:** Connect a LAN cable to synchronise measurement and setup data with a host PC over a Local Area Network

11) **USB A Socket:** Connect to printers or other external USB devices

12) (Type 2270 only) **Input Ch.1 Socket:** A triaxial LEMO connector – depending on the transducer used, a number of cables are available for connection. See section 2.3.1 for more information

2.3.1 Description of Inputs and Outputs

Top Socket

See item 17 in Fig. 2.1.

This 10-pin LEMO connector is the main microphone input for the analyzer. Microphone Type 4189 (including Preamplifier ZC-0032) is normally connected directly to this connector. If required, however, one of two microphone extension cables (AO-0697-D-030, 3 m, or AO-0697-D-100, 10 m), can be fitted between the input stage and the main microphone input socket, to extend the distance to the desired length.

For Type 2270, the microphone is connected to input Channel 1. In addition, you can use the Dual 10-pole Adaptor JP-1041 for accessing both input Channel 1 and input Channel 2.

USB Interface

See item 1 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

The USB Interface provides high-speed direct communication with your PC's USB port to synchronize measurement and setup data.

- Hardware versions 1 – 3: Use the supplied Mini USB Cable AO-1476
- Hardware version 4 (G4): Use the supplied Micro USB Cable AO-1494

Connect to a Printer via USB

For hardware versions 1 – 3, use the supplied Adaptor AO-0657 to connect to a printer that supports PCL language via the USB socket.

For hardware version 4 (G4), use the standard USB Type A socket (see item 13 in Fig. 2.3) on the analyzer to connect to printers or other external USB devices.

See section 8.1.7 for more information printer setup.

Earphone Socket

See item 2 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

The 3.5 mm minijack earphone socket enables the analyzer to be connected to a set of headphones/earphones, for reviewing recorded comments or for monitoring the measured sound. Use the supplied earphones, HT-0015.

Output

See item 3 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

This triaxial LEMO connector is used to output the conditioned input signal, for monitoring purposes, or to output the generator signal. Use cable AO-0440-D-015 (LEMO to BNC).

Trigger and Tacho Input

See item 4 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

This triaxial LEMO connector is used for the external trigger input, or start/stop signals to the analyzer, or for monitoring an external voltage. Using BZ-7222, BZ-7223, BZ-7224 or BZ-7225 software you can control signal recording (this requires a license for the BZ-7226 option). If you want to start and stop the recording using an external device, connect it to this input. See details in Appendix A.

Using FFT Analysis Software BZ-7230, this triaxial LEMO connector can also be used for speed measurements with Tacho Probe MM-0360 or other external tachometer signal. To connect a tacho probe, use one of the following cables:

- AO-0440-D-015: LEMO to BNC plug, 1.5 m
- AO-0727-D-010: LEMO to BNC jack, 1.0 m
- AO-0726-D-030: LEMO to SMB, 3.0 m (recommended with MM-0360)

Input 1 or Rear Socket Channel 1 (Type 2270 only)

See item 11 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

This triaxial LEMO connector is used for AC or CCLD inputs to Channel 1. It can be used when analysing electrical signals, from (for example) transducers or signal recordings. Use one of the following cables:

- AO-0440-D-015: LEMO to BNC plug, 1.5 m
- AO-0727-D-010: LEMO to BNC jack, 1.0 m
- AO-0701-D-030: Accelerometer cable, LEMO to M3, 3.0 m
- AO-0702-D-030: Accelerometer cable, LEMO to 10–32 UNF, 3.0 m
- AO-0722-D-050: Accelerometer cable, LEMO to MIL-C-5015, 5.0 m

Input (Input Ch.2 or Rear Socket Channel 2 for Type 2270)

See item 5 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

This triaxial LEMO connector is used for AC or CCLD inputs to Type 2250 or to Channel 2 of Type 2270. It can be used when analysing electrical signals, from (for example) transducers or signal recordings. Use one of the cables listed under Input 1.

External Power

See item 6 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

The analyzer is powered by an internal rechargeable battery pack. An indication of available charge is shown by the battery icon at the bottom of the screen. If the charge remaining is low or empty, the batteries can be recharged by connecting Mains Power Supply ZG-0426 to the ‘Ext. Power’ socket. When the power supply lead is connected, the icon will be displayed in place of the battery icon.

⚠ **CAUTION:** Use specified battery charger only.
Charging below 0 °C (32 °F) is not recommended.
Note: If you charge the battery pack below 0 °C,
the lifetime of the batteries will be reduced.
Do not charge battery pack in temperatures above 60 °C.
Do not disassemble or expose battery pack to fire or water.

Battery Charge Indicator

See item 7 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

A battery charge light (LED) indicates when the battery pack is being charged from external power:

- With hardware versions 1 – 3: The LED is a steady green light when external power is applied (and the battery is charging), and a flashing green light when charging has finished
- With hardware version 4 (G4): The LED is red when external power is applied (and the battery is charging); green when the battery is completely charged; and blue to indicate that the unit is in stand-by and battery powered

Reset Button

See item 8 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

Located above the USB connector, it is used to reset the analyzer if you have problems with the analyzer and cannot get it to operate. To reset, press the button with the point of the stylus – see chapter 9 for troubleshooting.

Slot for Compact Flash (CF) Cards (Hardware version 1 – 3 only)

See item 9 in Fig. 2.2.

This slot accepts CF sized cards and can be used for memory or, for example, a modem.

Slot for Secure Digital (SD) Cards

See item 10 in Fig. 2.2 (hardware versions 1 – 3) or item 9 and 10 in Fig. 2.3 (hardware version 4).

The SD slots accept SD and SDHC (Secure Digital High Capacity) memory cards, and are typically used to save measurement data. Capacities upto 32 gigabytes are acceptable.

Note: Hardware versions 1 – 3 have only one SD Card slot.

LAN Socket

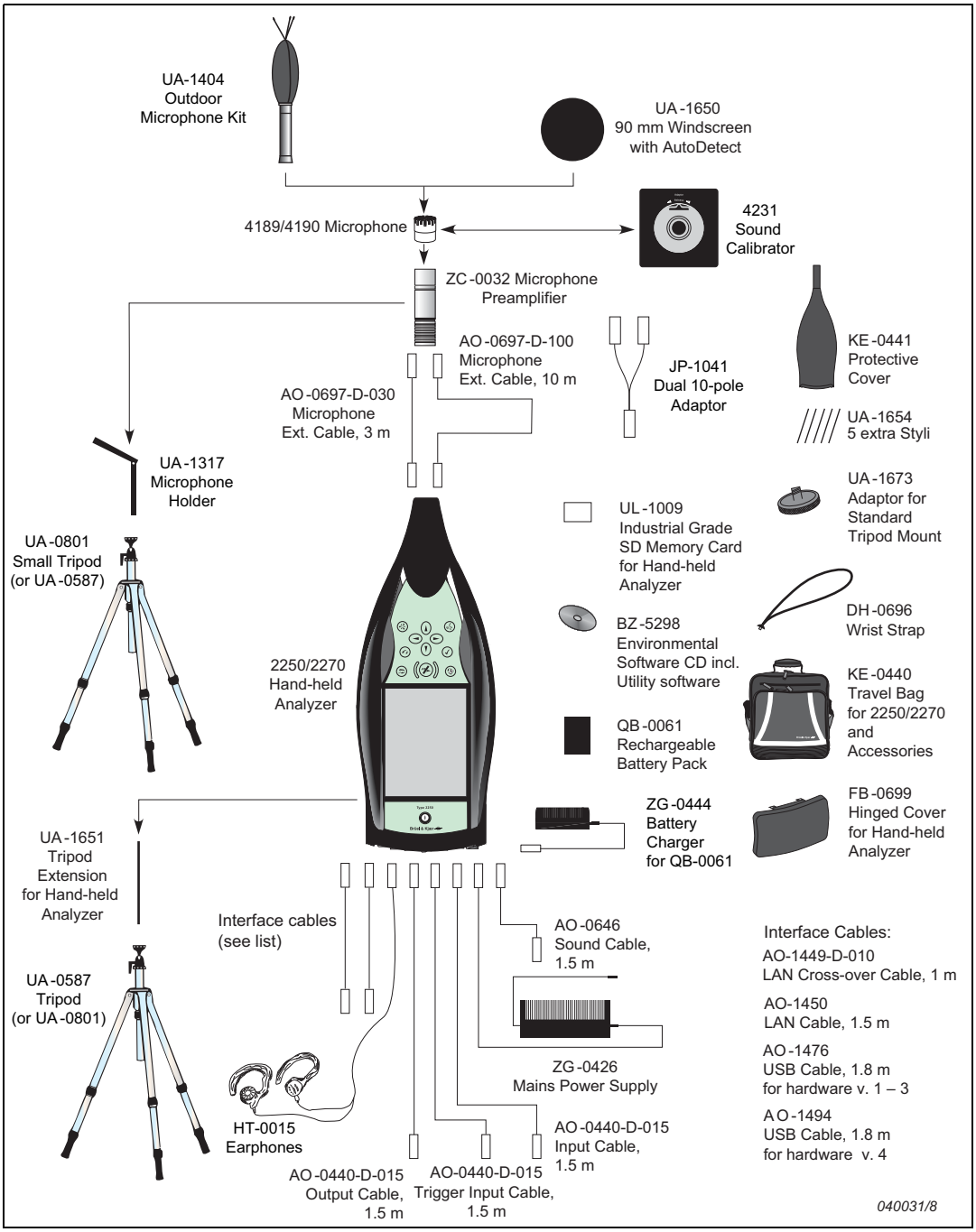
See item 12 in Fig. 2.2 (hardware versions 1 – 3) or Fig. 2.3 (hardware version 4).

All G4 hardware has one LAN socket with 100 Mbit connection. With hardware versions 1 – 3, only Type 2270 is equipped with a 10 Mbit LAN connection.

The LAN Socket provides high-speed direct communication with a Local Area Network. It is used to synchronise measurement and setup data with a host PC. The yellow LED on the right is on when there is a link. The green LED on the left blinks when there is activity on the LAN connection.

2.4 Hardware Setup

Fig.2.4 *Type 2250/2270 – Hardware Overview*



2.5 Assembling the Analyzer

2.5.1 Charging the Battery for the First Time

Battery Pack QB-0061 comes charged to approximately half capacity on initial delivery. Before assembling your analyzer for the first time, it is recommended that you fully charge the battery pack, by connecting Mains Power Supply ZG-0426 to the external power socket. It should take approximately 8 – 10 hours.

On hardware versions 1 – 3, the battery charge indicator shows a steady green light when external power is applied (and the battery is charging), and a flashing green light when charging has finished.

On G4 hardware, the light is red when the battery is charging and green when charging is finished.

You can leave the analyzer with external power on, even when the battery is fully charged.. Refer to section 9.4.3 for more information on the analyzer's battery.

2.5.2 Making Good Measurements

The fact that you are using your Type 2250 or Type 2270, which fully complies with the IEC 61672–1 standard, ensures you always make good measurements. The analyzer should be set up using the following recommended assembly instructions. This is to minimise the influence of acoustical reflections during measurements. All the components described below are shown in Fig. 2.1 and Fig. 2.4.

Another set of instructions are provided in section 2.5.3, for situations where you need to position the microphone at a distance from the analyzer, while still complying with the standard.

Placing the Measurement Microphone

The measurement microphone must be placed away from shielding, reflecting, or absorbing objects. In a diffuse sound field, absorbing objects will reduce the measured sound levels. In a free sound field, reflecting objects can change the measured sound levels. Typically, the sound level 0.5 m from a plane reflecting wall is 3 dB higher than if there was no wall.

The operator of the system may be personally shielding, absorbing, and reflecting, and can be an additional noise source. Measure downwind in dry conditions with a windspeed less than 5 m/s.

The optimum position for the microphone is best found by trying different positions and observing the resulting sound levels.

Mounting the Measurement Microphone

Before mounting the measurement microphone, note the following precautions:

- When screwing the microphone on, do it gently to avoid damaging threads
- Keep dust and foreign matter off the microphone diaphragm. Do not touch the diaphragm with anything – it is very delicate

Note: Once the measurement microphone and preamplifier have been assembled and connected to your analyzer, they should normally be left connected to the analyzer.

To Connect:

1) Gently screw the microphone onto Preamplifier ZC-0032, see items 1 and 2 in Fig. 2.1.

2) Insert the male plug of the preamplifier into the top socket of the analyzer (see item 17 in Fig. 2.1) and push gently until it snaps into position.

To Disconnect:

3) To disconnect the preamplifier and microphone from the analyzer, grip the locking collar firmly and slide back to remove the preamplifier and microphone combination.

Mounting the Windscreen

For short outdoor noise measurements (or indoor measurements exposed to air movement) mount Windscreen UA-1650 onto the microphone and preamplifier combination, making sure it 'snaps' into place over the windscreen sensor. The sensor is built into the preamplifier, see item 2 in Fig. 2.1. Icons in the status field on the screen indicate whether the windscreen is detected or not. For longer-term outdoor measurements, see Mounting the Outdoor Microphone Kit below.

Mounting the Analyzer onto the Tripod Extension Stem and Tripod

Mount the analyzer onto the Tripod Extension Stem UA-1651 and Small Tripod UA-0801, as follows:

1) Screw Tripod Extension Stem UA-1651 onto the threaded stud of the ball-joint on Small Tripod UA-0801. Secure the ball-joint roughly in a vertical position (that is, in-line with the tripod) until ready to follow the instruction in step 4.

2) Screw the Extension Stem UA-1651 into the analyzer, using the threaded socket at the lower back of the analyzer (see item 18 in Fig. 2.1).

3) Set Small Tripod UA-0801 (including the analyzer) in the required position, and adjust it to the required height. Ensure that one of the three legs is pointing roughly in the same direction as your analyzer needs to point. (We will refer to this leg as the front leg.)

4) Position the extension stem at an angle of 45 ° to the horizontal and vertically in-line with the front leg of the tripod – this is to ensure the whole setup is stable.

Note: The procedure is the same if Tripod UA-0587 is used instead of Small Tripod UA-0801.

Once you have carried out these instructions, you are ready to start measuring, see Chapter 3.

2.5.3 Alternative Measurement Method (Extended Microphone)

The measurement microphone can be placed a distance from the analyzer by connecting an extension cable and fitting the microphone to a microphone holder or to Outdoor Microphone Kit UA-1404. The analyzer should be set up using the following assembly instructions. This is to ensure that the accessories have limited acoustical influence on the analyzer during measurement. All the components described below are shown in Fig. 2.1 and Fig. 2.4.

Mounting the Outdoor Microphone Kit

For long-term outdoor measurements, Outdoor Microphone Kit UA-1404 will be required as an alternative to the windscreen. If this is the case, mount the kit onto the microphone and preamplifier combination according to assembly and mounting instructions in the User Manual for the Outdoor Microphone Kit, BE 1077.

Connecting a Microphone Extension Cable

The optional extension cables that are recommended for use with Type 2250/2270 are:

- AO-0697-D-030 – 3 m long
- AO-0697-D-100 – 10 m long

Note: Connecting a recommended microphone extension cable has no acoustical effect on the hand-held analyzer's measurement and has no effect on the analyzer's calibration. However, although it is not essential to re-calibrate, it is good measurement practice to calibrate the whole measurement chain (including microphone extension cable) before starting a measurement.

Decide which cable you require and assemble as follows:

1) Gently screw the microphone onto Preamplifier ZC-0032, see items 1 and 2 in Fig. 2.1.

2) Insert the preamplifier into the female plug of the extension cable and push gently until it snaps into position.

3) Insert the male plug of the extension cable into the top socket of the hand-held analyzer (see item 17 in Fig. 2.1) and push gently until it snaps into position.

Connecting Two Microphones (Type 2270 only)

To connect two microphones to a Type 2270, use the Dual 10-pole Adaptor JP-1041, two extension cables (AO-0697-D-030 3 m long or AO-0697-D-100 10 m long) and two Preamplifiers and two Microphones.

1) Gently screw the Microphones onto Preamplifiers ZC-0032, see items 1 and 2 in Analyzer Components (Fig. 2.1).

2) Insert the preamplifiers into the female plugs of the extension cables and push gently until into position.

3) Insert the male plugs of the extension cables into the female plugs of the dual 10-pole adaptor and push gently until they snap into position.

   Note: Channel 1 is tagged CH 1 and Channel 2 is tagged CH 2 on the dual 10-pole adaptor.

4) Insert the male plug of the dual 10-pole adaptor into the top socket of Type 2270 (see item 17 in Fig. 2.1) and push gently until it snaps into position.

Mounting the Measurement Microphone on the Microphone Holder and Tripod

Mount the microphone and preamplifier combination onto Microphone Holder UA-1317 and Small Tripod UA-0801, as follows:

1) Set Small Tripod UA-0801 in the required position, and adjust to the required height.
2) Screw Microphone Holder UA-1317 onto the threaded stud on the tripod ball-joint, and position the holder as required.
3) Push the microphone and preamplifier combination carefully into the microphone holder, so that it grips onto the body of the microphone and preamplifier. Ensure that the microphone cable sits properly in the plastic guide.

Once you have carried out these instructions, you are ready to start measuring, see Chapter 3.

2.5.4 Measuring for Convenience

Measurements that need to be done at short notice, with no particular accuracy can be carried out by simply holding the analyzer or using any combination of hardware components and accessories shown in Fig. 2.4.

2.5.5 Measuring Using Accelerometers

For vibration measurements you need an accelerometer as the measurement transducer. The accelerometer is connected to the rear socket of the analyzer.

Please refer to Chapter 3 of FFT Analysis Software User Manual BE 1778 for detailed information about selecting the right accelerometer and how to mount it correctly.

Chapter 3

Making your First Measurement

3.1 Introduction

This chapter describes how to make a basic measurement and how to save and document the results. It assumes you have just received your analyzer and are turning it on for the first time. If the analyzer has been used before, and the previous user has initiated the multi-user facility, then the screens that are displayed may not follow the sequence described below. If this is the case, please refer to section 8.1.6.

Note: A stylus is stored in a holder on the side of the analyzer, see item 15 in Fig. 2.1. This can be used on the touch-sensitive screen to select icons and functions during the procedures that follow. Alternatively, you can use the various pushbuttons, see items 3 to 11 in Fig. 2.1.

The following procedures assume that the measurement microphone and preamplifier have been mounted as described in Chapter 2 and the analyzer has a fully charged battery, see section 2.5.1.

3.2 Point and Shoot

Using the following basic procedure you will be able to start using your hand-held analyzer immediately to make measurements and start the familiarisation process:

1) Switch on by pressing ⏻ and make sure the **Sound Level Meter** project template is selected (see section 3.3.3 for instructions).

2) Check that the data path at the top of the screen displays the correct job/project, (that is, where you want to save the new data). See section 6.1.1.

3) Set *Measurement Mode* to *Manual* and change any setup parameters by tapping the **Main Menu** icon ☰ and selecting **Setup** from the drop-down that appears.

4) Press the **Start/Pause** pushbutton, then monitor the status indicator (traffic light).

5) Use the **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons to control the measurement.

6) When measurement has finished, press the **Save** pushbutton to save your data.

7) Add any spoken comments to the measurements by pressing the **Commentary** pushbutton, and add any written comments by tapping the **Main Menu** icon and selecting *Add Note to Current Measurement* from the drop-down that appears.

8) To view and organise your data, tap the **Main Menu** icon and select *Explorer.*

Note: You are not required to set any measurement ranges, the analyzer has a dynamic range of more than 120 dB, from 140 dB down to the noise floor of the microphone, (if the microphone has nominal sensitivity).

3.2.1 Congratulations!

You should now be familiar with the basic principles of the analyzer. If you need more help, the following section goes into the measurement process in more detail. If not, please refer to Chapter 1.

3.3 Making a Measurement

3.3.1 What is a Project Template?

A project template contains all the common display settings and measurement setups required to perform a noise measurement. The template does not contain any measurement data – these data are saved as individual projects, stored in job folders, see section 6.1.1. The project templates covered by this manual, are:

- Sound Level Meter (included in BZ-7222 software)
- Frequency Analysis (included in BZ-7223 software)
- Logging (included in BZ-7224 software)
- Enhanced Logging (included in BZ-7225 software)
- Reverberation Time (included in BZ-7227 software)

Note 1: Signal Recording Option BZ-7226 does not contain a specific template – signal recording options are available in all templates.

Note 2: Tone Assessment Option BZ-7231 does not contain a specific template – tone assessment options are available in all templates included in BZ-7223/24/25/30.

Note 3: Low Frequency Option BZ-7234 works with all the templates included in BZ-7222/23/24/25

Note 4: 2-channel Option BZ-7229 (for Type 2270) enables 2-channel operation for all 2-channel templates included in BZ-7222/23/24/25/28 and for Signal Recording Option BZ-7226 and Low Frequency Option BZ-7234.

If you make any changes to the settings in a project template, an '∗' will appear next to the template name to indicate that the new settings have not been saved. Tap the template name at the top of the display to open the **Template Explorer** (or select it from the **Main Menu**) and tap the **Save** icon to save the settings in the current template.

3.3.2 Switching On

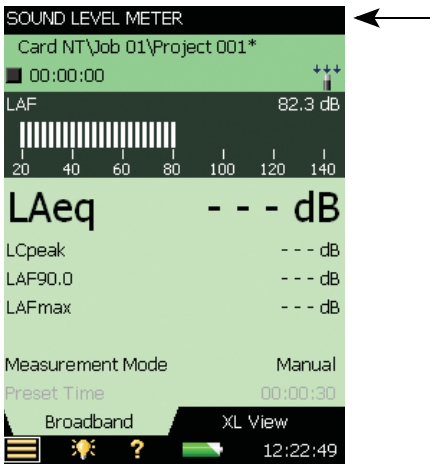
Switch the analyzer on by pressing ⏻. The start-up time depends on the state the analyzer was in when last switched off and it may take up to 2 minutes from a cold start, or up to 10 seconds if the analyzer is already in Standby mode, (that is, from a warm start).

Note: A cold start is a re-boot of the analyzer from ROM. This normally occurs after the analyzer has been turned off for some time, either by the user or following an automatic power-down. A warm start takes the analyzer quickly from Standby mode to fully operational without having to re-boot. (The battery needs to be charged for this to happen, see section 2.5.1.)

3.3.3 Set the Sound Level Meter Project Template

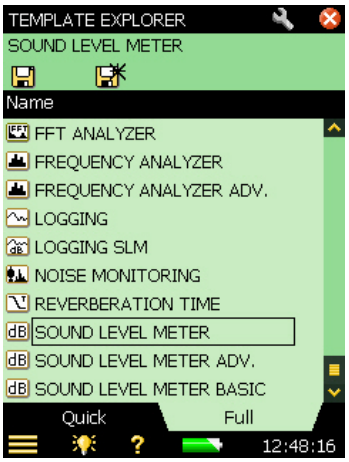
After initialization, the screen shown in Fig.3.1 appears:

Fig.3.1
Initial sound level meter screen



1) Check that the **SOUND LEVEL METER** project template is displayed at the top of the screen (Fig.3.1. If not, use the stylus to tap the bar at the top of the screen to reveal the Template Explorer and select *Sound Level Meter* from the list (Fig.3.2). Select *Open*.

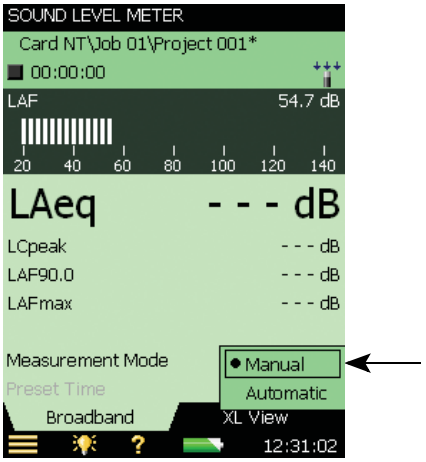
Fig. 3.2
Changing the project template



2) Tap *Measurement Mode* in the View Area and set to *Manual* (Fig. 3.3).

Note: The bar graph showing the sound pressure level L_{AF} is now live, but parameters such as L_{Aeq} are not. This is because L_{AF} is an instantaneous value, always available for display, whereas L_{Aeq} is a measured value that needs to be averaged over a period of time. Therefore, it cannot be displayed before you have started a measurement using the **Start/Pause** pushbutton.

Fig. 3.3
Setting the measurement mode



3) Press the **Start/Pause** pushbutton to start the measurement.

Note: *Start* briefly appears on the screen as feedback when you press the **Start/Pause** pushbutton.

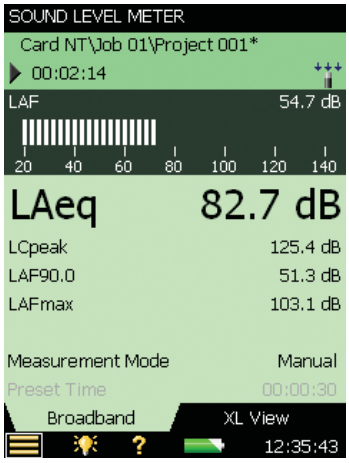
Notice the **Running** icon ▶ on the screen and monitor the red, yellow, green status indicators around the **Start/Pause** pushbutton while you are measuring.

The indications should be as follows:

- Yellow status indicator flashing every 5 s before starting the measurement
- Steady green status indicator after pressing the **Start/Pause** pushbutton and during the measurement (if everything is OK)
- Short green flash every second means the measurement is waiting for the trigger
- Yellow status indicator flashing every 5 s when you have stopped, saved the measurement and are ready to do another measurement
- Yellow status indicator flashing slowly (0.5 s on, 0.5 s off) when paused
- Red status indicator flashing rapidly if you encounter an overload condition during the measurement

4) Use the **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons to control the measurement. The status field at the top of the screen will give short textual feedback on the pushbutton operation. A visual indication of measurement status is also displayed on the status line, by way of the **Stopped** icon ■, the **Running** icon ▶ and the **Paused** icon ❙❙ (Fig. 3.4).

Fig. 3.4
Measurement feedback in the Status Field



5) Toggle between different display parameters, as required, by tapping on each parameter field (for example LAF90.0 in Fig. 3.4) with the stylus and selecting other parameters from the drop-down lists that appear.

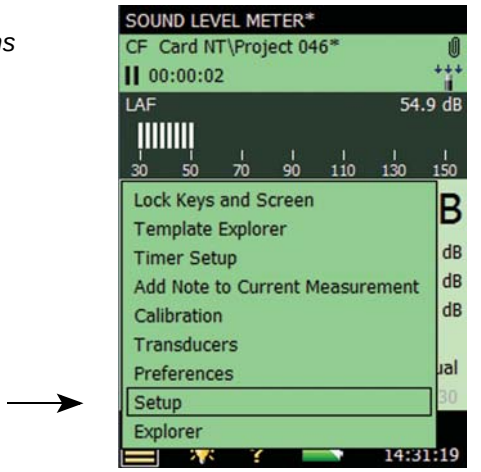
Note: The tabs at the bottom of the screen allow you to choose different ways of displaying the measurement results:

- The **Broadband** view shows an instantaneous L_{AF} readout, with associated bar graph and four measurement parameters, followed by two measurement setup parameters. (The first parameter is displayed in a larger font size for better readability (Fig. 3.4))
- The **XL View** increases the size of the first parameter readout to a four-digit, full-screen display (including decimal point)

6) Set *Measurement Mode* to *Automatic* and choose a preset time for your measurement. Then repeat steps 3 and 4. The measurement will automatically pause after the preset time. This allows you to either save your measurement or continue measuring, as required.

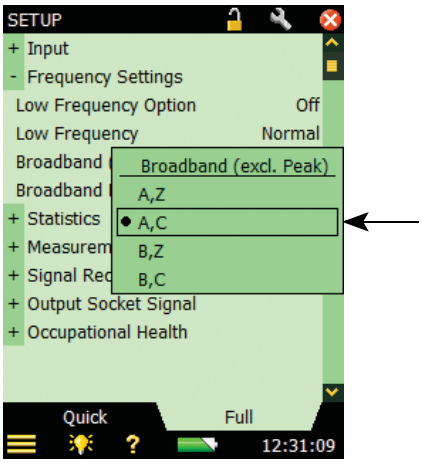
7) Tap the **Main Menu** icon and select *Setup* from the list of options (Fig. 3.5).

Fig. 3.5
Main Menu options



Change the broadband weighting parameters by tapping on the 'plus' icon + next to *Frequency Settings*, then on the weighting parameter field on the right side of the screen. A weighting drop-down menu will appear (Fig. 3.6). Change the parameters as required.

Fig. 3.6
Changing the broadband frequency settings



8) Return to the bar graph screen of the Sound Level Meter template by tapping and you are ready to make a new measurement.

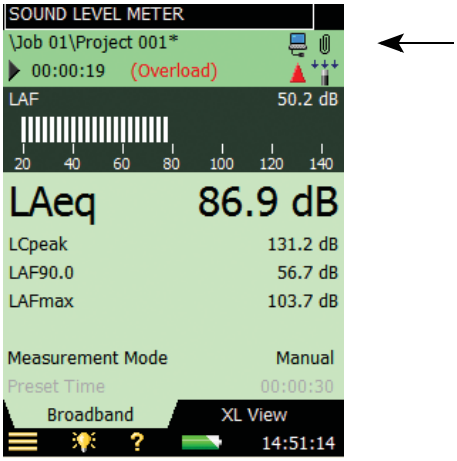
3.4 Save your Measurement

When you have completed your measurement, you need to save it. By default the analyzer creates a job folder called *JOB 01*. Job folders represent the upper level of the data (or file) management system, with individual measurements or sets of data, represented by projects appearing under the relevant job. By default the analyzer also creates a project called *PROJECT 001* under *JOB 01*. (Subsequent measurements will be labelled *PROJECT 002*, *PROJECT 003*, etc., under *JOB 01*. This will happen each time you have saved a measurement*.)

Check that the data path at the top of the screen displays *\JOB 01\PROJECT 001** and save your measurement by pressing the **Save** pushbutton. For more details refer to section 6.1.

Note: An asterisk will appear alongside the project at the top of the Status Field as soon as you start your measurement (Fig.3.7). This signifies that the measurement has not been saved. It will disappear once you have saved the measurement.

Fig.3.7
Saving your measurement

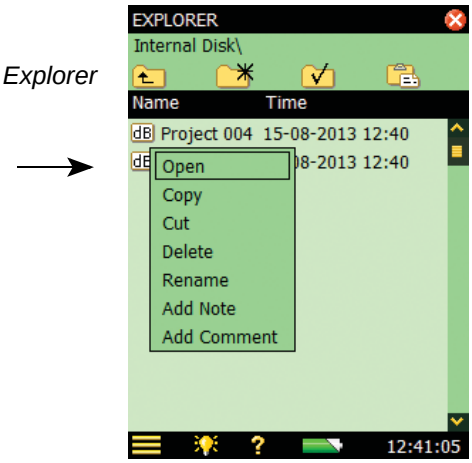


*. If you are using Reverberation Time Software BZ-7227, please note that there are **more** measurements stored in Reverberation Time projects than Sound Level Meter, Frequency Analyzer or Logging projects, which all contain one measurement within each project. See Chapter 14 for more information on BZ-7727.

3.4.1 Viewing the Saved Measurement

To view the saved measurement, tap the project name or the **Main Menu** icon and select *Explorer* from the list of options. Tap the name of your measurement (*PROJECT 001* in this case) and select *Open* from the drop-down that appears (Fig. 3.8). Alternatively, you simply tap the measurement icon to the left of the name to open and view.

Fig. 3.8
Viewing your measurement in Explorer



3.5 Document your Measurement

One method for documenting your measurement is adding metadata to your project. Tap (upper right corner of the screen (Fig. 3.7)) to open the Annotations screen with metadata on the **Metadata** tab and annotations on the **Annotations** tab (Fig. 3.9).

Note: If the icon is not visible, you have no metadata or annotations at all. Move the field selector into the line using the arrow keys and move it right until the icon is revealed.

Fig. 3.9
The Metadata tab of the Annotations screen

Metadata are text or numbers, which are easily set and changed using the keyboard or selected from a user-defined picklist. The metadata are stored together with the measurement on the project. Refer to section 8.7 for a more comprehensive description of using metadata.

Tap the icon to close the Annotations screen.

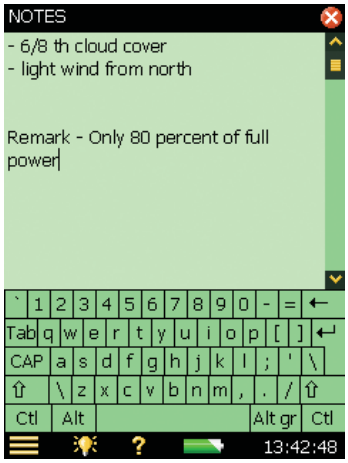
Another method for documenting your measurement is by attaching a short spoken comment to the project you are working on. This is done before, during* or after saving the measurement by pressing and holding down the **Commentary** pushbutton, while talking to the analyzer. (The microphone situated on the underside of the analyzer will pick up your comments.) Recording stops when you release the pushbutton.

Note: Tap the **Annotations** icon to see a list of all annotations in the project and tap the **Loudspeaker** icon in the annotation to hear the comment using the earphones plugged into the earphone socket.

A third method is to make a short written comment and attach it to the project you are working on. This is done before, during or after saving the measurement by tapping the **Main Menu** icon and then tapping on *Add Note to Current Measurement* in the list of options. A blank Notes screen will appear, where you can make written comments about the measurement, using the standard full character keyboard that appears at the bottom of the Notes screen. See the example in Fig. 3.10.

Tap the **Annotations** icon to see a list of all annotations in the project and tap the **Text** icon in the annotation to view the comment.

Fig. 3.10
Example of a written annotation that is attached to a measurement



A fourth method is to attach a note with the GPS position. Similar to adding notes, adding a GPS note can also be done before, during or after saving the measurement by tapping the **Main Menu** icon then tapping *Add GPS Note to Cur. Measurement* in the list of options.

*. For Logging Software BZ-7224 and Enhanced Logging Software BZ-7225, annotations can be added directly to the measurement profile during the measurement, see section 11.2.

If a GPS receiver is connected (via USB) when you press the **Save** pushbutton, then the GPS note is automatically created with the position. Remove the GPS receiver after usage to save power.

Fig. 3.11
Example of a GPS note

If you do not have a GPS receiver, but know the position (for example, from your smartphone), you can manually key in the position in the GPS note.

A GPS note starts with "Position:", and includes the latitude and longitude. For manual entries, please enter the latitude and longitude in one of the following formats:

Degrees: *DD.dddddY DD.dddddX*

Example: 55.816730N 12.532855E

Degrees Minutes: *DD MM.mmmmY DD MM.mmmmX*

Example: 55 49.0038N 12 31.9713E

Degrees Minutes Seconds: *DD MM SS.sssY DD MM SS.sssX*

Example: 55 49 0.288N 12 31 58.278E

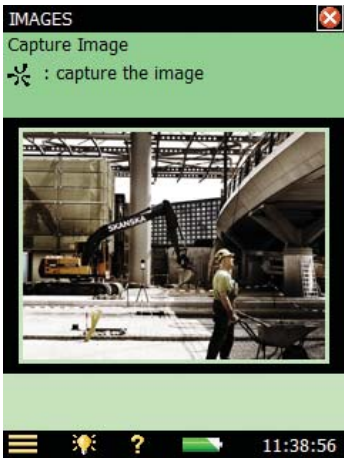
where *X* = E or W and *Y* = N or S. If you use degrees only, then you can use +/– instead of N/S and E/W (example: 43.08011N,79.071007W = 43.08011,–79.071007). You can use "," instead of "space" between latitude and longitude

The GPS note can be used by Measurement Partner Suite BZ-5503 to locate the measurement on Google Maps™.

A fifth method is to attach an image (Type 2270 only). Similar to adding notes or comments, adding an image can also be done before, during or after saving the measurement by a tap **Main Menu** icon and then a tap *Add Image to Current Measurement* in the list of options. The Viewfinder display will then appear showing what is coming through the camera lens. The

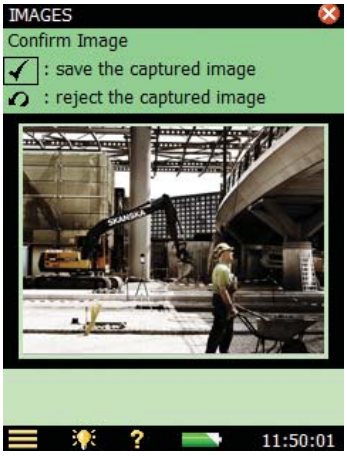
camera has fixed focus and automatically adjusts the light sensitivity; you just have to position the analyzer so that the object you want to capture is visible in the viewfinder and then press the **Manual Event** pushbutton or tap the icon to capture the image – see Fig.3.12.

Fig.3.12
Viewfinder



When captured, the image is presented as a still picture and you can save the captured image by pressing the **Save** pushbutton (or by closing the **Images** view), or you can reject the image by pressing the **Back-erase** pushbutton.

Fig.3.13
Viewfinder



Note: When finished, tap the icon to return to the Measurement screen. Tap the **Annotations** icon to see a list of all annotations in the project and tap the **Camera** icon in the annotation to view the image.

To get more familiar with this process, try the following:

1) Make a new measurement (see section 3.2, if unsure).
2) Tap the **Annotations** icon and define or select metadata.
3) Make a short written comment and attach it to the new measurement (as previously described).
4) Make a short spoken comment (as previously described).
5) Make an image (as previously described – for Type 2270 only).
6) Tap the **Annotations** icon and check that you have three annotations – select one of them to see/hear the annotation.

3.6 Switching Off

Switch the analyzer off by pressing ⏻. If held in for 1 second, the analyzer goes into Standby mode; if held in for more than 4 seconds, it switches the analyzer off.

The analyzer will automatically switch off when it has been in Standby mode without external power for more than 30 hours.

Chapter 4

Getting to Know Your Analyzer

4.1 What is a Sound Level Meter?

A Sound Level Meter (SLM) is an instrument that is designed to measure sound levels in a standardised way. An SLM comprises a microphone, a preamplifier, a main processor and a read-out unit. The microphone converts the sound signal into an equivalent electric signal. The electric signal that the microphone creates is at a very low level, so it is made stronger with the help of a preamplifier before it is processed by the main processor.

Processing includes applying frequency and time weightings to the signal as specified by international standards, such as IEC 61672−1, to which the analyzer conforms.

Frequency weighting adjusts how the SLM responds to different sound frequencies. This is necessary because the human ear's sensitivity to sound varies according to the sound's frequency. The most commonly used frequency weighting is A-weighting, which adjusts a signal in a way that best resembles the human ear's response at medium-range levels. A-weighting is required for nearly all environmental and workplace noise measurements, and is specified in international and national standards and guidelines. All of the analyzer's measurement parameters apply A- or B-weighting and a choice of C- or Z-weighting, except for the measurement of peak levels where a single weighting (typically 'C') is applied. In this case, C-weighting is used to take into account the energy present at low frequencies even when they are not particularly annoying.

Time weighting specifies how the SLM reacts to changes in sound pressure. It is an exponential averaging of the fluctuating signal, providing an easy-to-read value. The analyzer applies Fast, Slow and Impulse (or 'F', 'S' and 'I') time weightings, which are the required weightings according to the vast majority of international and national standards and guidelines.

The signal is processed through the weighting filters, and the resulting sound pressure level is displayed in decibels (dB) referenced to 20 µPa on the analyzer's screen. The sound pressure level values are updated at least once per second.

Assessing a fluctuating noise level means getting a value for a level that is, in simple terms, the average level. The 'equivalent continuous sound level', L_{eq}, is known around the world as the essential averaged parameter. L_{eq} is the level that, had it been a steady level during the measurement period, would represent the amount of energy present in the measured,

fluctuating sound pressure level. It is a measure of the averaged energy in a varying sound level. It is not a direct measure of annoyance, though extensive research has shown that L_{eq} correlates well with annoyance.

L_{eq} is measured directly with any SLM. If an A-weighting filter is used, it is expressed as L_{Aeq}: *the measurement of the equivalent continuous sound level using the A-weighted filter network.*

A full range of measurement parameters is given in Appendix B.

4.2 What is the Hand-held Analyzer?

The hand-held analyzer is a versatile hardware platform suitable for covering a wide range of different applications. Together with Sound Level Meter Software BZ-7222, it is a Class 1 modular precision integrating-averaging sound level analyzer with an easy to use interface for quick and simple measurement setups.

4.2.1 Sound Level Meter Software Module BZ-7222

Sound Level Meter Software BZ-7222 allows you to measure a comprehensive set of parameters used for rating noise in terms of its impact on the environmental and working environments and on occupational noise evaluation.

The more commonly used parameters for sound measurements, which cover a large range of applications, are either instantaneous measured parameters (available at any time) or timed measured parameters (measured within a controlled time interval):

Timed Measured Parameters

- Equivalent Continuous Sound Levels (L_{eq} – example: L_{Aeq})
- Moving (or sliding) Equivalent Continuous Sound Levels (example: $L_{Aeq,T,mov}$ and $L_{Aeq,T,mov,max}$)
- Peak Sound Levels (L_{peak} – example: L_{Cpeak})
- Time for Peak Sound Level (example: T_{Cpeak})
- Maximum Time-weighted Sound Levels (L_{max} – example: L_{AFmax})
- Minimum Time-weighted Sound Levels (L_{min} – example: L_{AFmin})
- Percentile Levels (L_N – example: $L_{AF90.0}$)
- Sound Exposure Level (example: L_{AE})
- Sound Exposure (example: E)
- Daily Noise Exposure Levels (example: $L_{ep,d}$ or $L_{EX,8h}$)
- Noise Dose (example: based on ISO standards: Dose, based on US standards: DoseS5)
- Number of Peaks (example: #CPeaks(>140 dB))
- Time Weighted Average (example: TWA)
- Level Average with Exchange Rates 4, 5 or 6 (example: L_{avS5})
- Weather data (requires a weather station connected)
- GPS data (requires a GPS device connected)

Instantaneous Measured Parameters

- Instantaneous Time-weighted Sound Levels (L_p – example: L_{AF})
- Sound Pressure Levels (max levels once per second – example: L_{AF}(SPL)
- Instantaneous Peak Sound Levels (example: $L_{Cpeak,1s}$)
- Instantaneous Weather data (requires a weather station connected)
- Instantaneous GPS data (requires a GPS device connected)

If you measure the acceleration signal from an Accelerometer, then the most common used parameters are:

Timed Measured Parameters

- Average (example: Linear)
- Peak (example: Peak)
- Time for Peak (example: Tpeak)
- Maximum Time-weighted parameters (example: Fast max)
- Minimum Time-weighted parameters (example: Slow min)
- GPS data (requires a GPS device connected)

Instantaneous Measured Parameters

- Instantaneous Time-weighted parameters (example: Fast Inst)
- Instantaneous GPS data (requires a GPS device connected)

The acceleration parameters can be displayed in either Engineering units (m/s^2) or in dB.

Note: See Appendix B for a comprehensive list of all parameters.

Sound Level Meter Software BZ-7222 incorporates a simple user interface that is easy to learn and uses intuitive data storage and recall. Comprehensive security features mean no loss of data, even on accidental power-off. Smart features are built-in for field use, for example, allowing you to personalise your measurements. Sound Level Meter Software BZ-7222 also provides connectivity between your PC and other sound analysis software.

This highly versatile hand-held analyzer platform includes a range of optional software modules, that are enabled through easily activated software license keys. The combination of software modules and innovative hardware makes the analyzer a dedicated solution for performing all your high-precision measurement tasks. The following optional software module is covered in this manual:

4.2.2 Frequency Analysis Software Module BZ-7223

This software module allows real-time frequency measurements in 1/1- and 1/3-octave bands, making it a simple matter to, for example, select suitable hearing protection, qualify noise from heat and ventilation systems and assess tonality.

4.2.3 Logging Software Module BZ-7224

This software module allows logging of broadband and spectral data* to obtain a time history for later analysis, for example, for use in environmental noise as well as workplace noise assessment. It allows free selection of up to 10 parameters to log at periods from 1 s to 24 h. Results are logged directly to the SD memory card (or CF card if using hardware versions 1 – 3).

4.2.4 Enhanced Logging Software Module BZ-7225

This software module is optimised for long-term monitoring. It has the functionality of the Logging and Frequency Analysis software, and in addition it can measure continuously, save data in manageable portions (every 24 hours), make periodic reports (that is, every hour) and measure L_{dn} and L_{den}, etc.

4.2.5 Signal Recording Option BZ-7226

This option allows recording of the input signal (typically sound) in either 16-bit or 24-bit resolution during measurement. The signal recording can be controlled manually or by using an external trigger signal. The recording can also be triggered when a measured parameter exceeds a preset level (BZ-7224 and BZ-7225 only). The recorded signal can be played back and listened to using the supplied Earphones HT-0015. The signal is recorded directly to the SD memory card (or CF card if using hardware versions 1 – 3).

4.2.6 Reverberation Time Software BZ-7227

This software module allows measurement of reverberation time using Impulsive excitation and backwards integration of the impulse, or using Interrupted Noise from the built-in noise generator. Measurements can be made in a number of positions in the room and the average reverberation time for the room is calculated.

4.2.7 2-channel Option BZ-7229 (Type 2270 only)

This option allows a number of software modules to measure two channels simultaneously:

- Sound Level Meter BZ-7222, Frequency Analysis BZ-7223, Logging BZ-7224, Enhanced Logging BZ-7225 and Building Acoustics Software BZ-7228 modules
- Signal Recording Option BZ-7226 will be able to record in both channels of a two channel measurement

*. Requires Frequency Analysis Software BZ-7223

4.2.8 Tone Assessment Option BZ-7231

This option allows the assessment of tones on site, according to selected methods. The option described in this manual is based on the 1/3-octave method. (Please refer to User Manual BE 1778 for detailed information about tone assessment based on FFT spectra.) When used with BZ-7223 Frequency Analysis, BZ-7224 Logging and BZ-7225 Enhanced logging, it allows you to assess tones in a measured 1/3-octave spectrum according to ISO 1996:2007, Annex D, or, assess tones in a measured 1/3-octave spectrum according to Italian Law, “Ministero dell’ambiente, Decreto 16 marzo 1998”.

4.2.9 Low Frequency Option BZ-7234

This option enables:

- Measurements down to 0.4 Hz using Brüel & Kjær low-frequency microphones and adds G-weighting parameters in accordance with ISO 7196:1995
- Measurements of building vibration parameters using Brüel & Kjær low-level accelerometers in accordance with ISO 2631–2:2003, ISO 8041:2005, DIN 45669–1:2010–09 and DIN 4150-2:1999–06
- 1/3-octave frequency analysis down to 0.8 Hz (1/1-octave down to 1 Hz)

This option can be used together with Sound Level Meter BZ-7222, Frequency Analyzer BZ-7223, Logging BZ-7224 and Enhanced Logging BZ-7225 software modules and the 2-channel Option BZ-7229.

4.2.10 Built-in Help

If you need more detailed information at any time during operation, tap the **Help** icon on the analyzer’s screen. The resulting screen will explain that particular item in much more detail. You can scroll up and down the explanatory text using either the ▼ and ▲ pushbuttons, or the scroll bar on the screen. Return to the normal display screen by tapping .

If you need to view any of the previous 10 screens you have visited in the help system, tap the icon at the top of the display.

Software and Hardware Versions

Once in the help system, you can access the list of installed software versions and licenses, together with information about the hardware. This information is always available and is accessed by selecting **About** from the top of the display.

4.3 What is Measurement Partner Suite BZ-5503?

Measurement Partner Suite BZ-5503 comes standard with your hand-held analyzer and provides data archive, preview and export capabilities as well as software maintenance and remote online display. In addition to the included standard configuration, valuable data analysis and post-processing functionality is available in an expanding suite of optional application modules.

The software enables you to do the following:

- Setup or control the analyzer from a PC
- Retrieve data from the analyzer
- Manage and archive data from the analyzer
- View data in archives
- Update the software in the analyzer
- Install licenses for use of software modules in the analyzer
- Remotely view online displays
- Post-process data (optional)
- Export to other post-processing and documentation tools like Evaluator™ Type 7820 or Microsoft® Excel® or Word

Measurement Partner Suite BZ-5503 is supplied on the Environmental Software DVD (BZ-5298), which is included with your analyzer.

4.4 Basic Principles when using the Analyzer

4.4.1 Navigation Principles – ‘Star’ Navigation Concept

The main principle is that all the main menus are accessible via a single tap of the stylus. The **Main Menu** icon forms the centre of the ‘star’ navigation concept (Fig. 4.1).

Fig.4.1 *The 'Star' navigation concept*

This configuration gives you immediate access to screens you need most, that is, those you will need to perform, save and document your measurements. The **Main Menu** allows you to navigate to the following screens::

- Explorer
- Setup
- Preferences
- Transducers
- Calibration
- Add Note to Current Measurement
- Add Image to Current Measurement (Type 2270 only)
- Template Explorer
- Timer Setup

In addition, **Main Menu** also allows you to perform the following actions:

- Lock Keys and Screen
- Log Off

Explorer

The Explorer screen is accessed from the **Main Menu** or by tapping the project name and gives you access to the analyzer's Data/Project Manager. This allows you to view the overall project structure, including job folders and projects, and to view all the individual measurements. When you have finished, tap to return to the Measurement screen.

You can tap any measurement file to open the saved measurement and if there are any voice text or image annotations attached, these can be viewed by tapping the **Paperclip** icon visible next to all measurement files with attachments. When you have finished reading, listening or viewing the attachments, tap to return to the Explorer screen.

Setup

The Setup screen is accessed from the **Main Menu** and gives you access to the various setup parameters, such as frequency weightings, control of the measurement, bandwidth, statistics and the type of input currently connected. You can change these as required, see section 4.4.6.

The **Full** tab at the bottom of the screen allows you to view the complete list of setup parameters, while the **Quick** tab allows you to access the more frequently used parameters defined by yourself. When you have finished viewing or updating the parameters, tap to return to the Measurement screen.

Changes made to the setup will only be applied temporarily, that is, until you select another project template or open another project to re-use the setup from that project. However, if you want the setup changes to be saved in the current template, select the *Template Explorer* option from the **Main Menu** and tap the **Save** icon .

Note: If you make changes to the setup that you do not want to keep (and you have not yet saved the template), you can undo them by selecting the template again from the Project Template Bar at the top of the screen.

Preferences

The Preferences screen is accessed from the **Main Menu** and gives you access to the analyzer's preferences (if *Multi User* is disabled) or your own preferences (if *Multi User* is enabled). These include things such as regional settings, appearance of the screen, power management, user profiles and language. You can change these as required, see section 4.4.6. For more information refer to section 8.1. When you have finished viewing or updating the parameters, press to return to the Measurement screen.

Transducers

The Transducers screen is accessed from the Main Menu, you can view/set which transducer is connected to the analyzer and add new ones if required. Details can be changed for existing

transducers or entered for new ones, see section 4.4.6. When you have finished viewing or updating the details, tap to return to the Measurement screen.

When a transducer is selected, you can tap the *Calibration History* link at the bottom of the transducer details and open the Calibration History screen (Fig.4.1). This screen includes the calibration history for the transducer (that is, microphone) that is currently selected. When you have finished viewing or updating the details, tap to return to the Transducers screen.

Calibration

The Calibration screen is accessed from the Main Menu, and gives you access to the analyzer's calibration procedure. To calibrate the analyzer, follow the instructions in the Status Field. For more information refer to section 5.2. When you have finished calibrating or viewing the details, tap to return to the Measurement screen.

The **Calibration** tab at the bottom of the Calibration screen allows you to perform and monitor the calibration, while the **Details** tab allows you to view the details of the calibration and the calibrator that are being used to calibrate the analyzer. While you are viewing the **Details** tab, you can tap the *Calibration History* link at the bottom of the calibration details and open the Calibration History screen (Fig.4.1). This screen includes the calibration history for the currently selected transducer, tap to return to the Calibration screen.

Add Note to Current Measurement

The Notes screen is accessed from the Main Menu by selecting *Add Note to Current Measurement*. This screen allows you to create a text annotation that you can attach to your measurement. Text is inserted using a character keyboard, similar to the one covered in section 4.4.6. When you have finished, tap to return to the Measurement screen.

Add Image to Current Measurement (Type 2270 only)

The Images screen with a viewfinder is accessed from the Main Menu by selecting *Add Image to Current Measurement*. This screen allows you to capture an image that you can attach to your measurement – see Chapter 3. When you have finished, tap to return to the Measurement screen.

Template Explorer

Template Explorer is accessed from the Main Menu and gives you access to managing your project templates. When you have finished, tap to return to the Measurement screen.

Timer Setup

Timer Setup is accessed from the Main Menu and enables you to control the analyzer via one or more of the analyzer's timers. The purpose of a timer is to initiate measurements in the absence of an operator. When you have finished, tap to return to the Measurement screen.

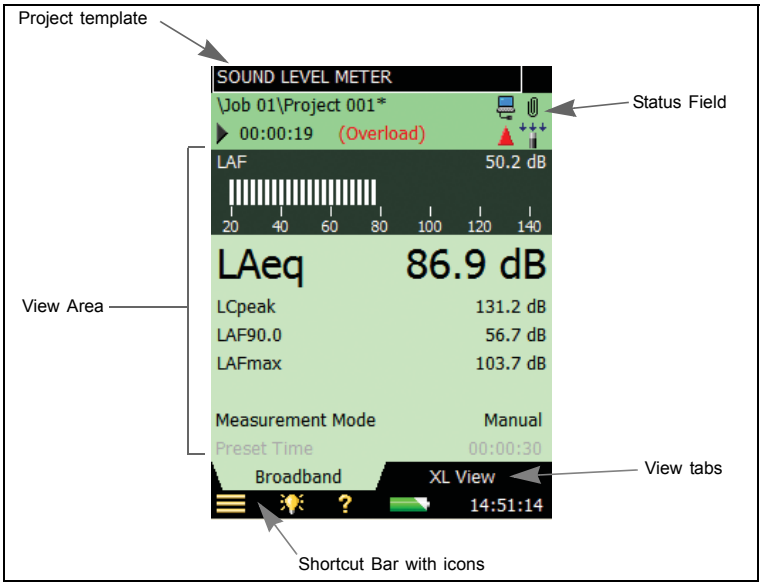
4.4.2 The Display Screen

During normal operation, you will use the Display screen to view your measurements and carry out a variety of functions, which are described in the following sections.

CAUTION: The touch-sensitive screen is susceptible to damage from sharp objects, such as pencils, fingernails, etc. We, therefore, recommend you use the stylus provided to activate items on screen. See also section 4.4.5.

A typical screen is shown in Fig.4.2.

Fig.4.2
Typical screen when making a measurement



The main areas, starting at the top of the screen, are:

- Project Template Bar
- Status Field
- View Area (with view tabs)
- Shortcut Bar

Project Template Bar

This bar displays the name of the project template, which contains all the screen settings and measurement setup for the current project. Tap the text to open the Template Explorer screen containing all the available templates. If you make any changes to the setup in a template an '∗' will appear next to the template name to indicate that the new settings have not been saved. Tap the **Save** icon in the Template Explorer to save the settings in the current template.

Status Field

The area just below the Project Template Bar is called the Status Field. Depending on the template, this field displays status information using up to three lines of text, as follows:

First Line:

- Path and name of the current project (see section 6.1.1). Tap it to open the Explorer. To change the path, navigate to the desired job (path) and tap the icon to save this path as the default measurement path. As in the project template, an '∗' will appear next to the project name to indicate that the project has not been saved. Press the **Save** pushbutton if you want to save the measurement or changed settings.
- Smiley (if applicable)
- The **PC** icon indicates connection to a PC
- The **Commentary** icon indicates when a spoken commentary is being recorded, together with an indication of the available recording time
- The **Recording** icon indicates when the measurement signal is being recorded
- A **Paperclip** icon indicates that a spoken or written comment is attached to the project. Tap the icon to view, or listen to, the comment

Second Line:

- Measurement state represented as icons: Stopped ■, Running ▶ and the Paused icon ❙❙
- Elapsed time of the measurement
- Feedback on the action of pressing the following pushbuttons: **Reset**, **Back-erase**, **Start/Pause** and **Save**
- Indication that the measurement microphone is uncalibrated. In this case the word *Uncal.* appears in the Status Field
- When a microphone has been selected as input, then four icons are used to represent whether, or not, the windscreen is fitted and whether you are measuring in a free-field or diffuse field. For example, no windscreen fitted, measuring in a free-field – ; no windscreen fitted, measuring in a diffuse field – ; windscreen fitted, measuring in a free-field – ; windscreen fitted, measuring in a diffuse field – . The **Accelerometer** icon is displayed if an accelerometer is selected as input, and the **Input Socket** icon is displayed if Direct input is selected. For Type 2270, two icons are displayed – one for Ch. 1 and one for Ch. 2. If only one channel is used, then no icon is displayed for the unused channel
- Immediate textual feedback on overload/underrange situation and latched overload indicated with an **Overload** icon

Third Line:

- Used for Logging and Enhanced Logging, see section 11.3.1, or used for Reverberation Time, see section 14.3.1

View Area

The View Area contains the screens required for a particular measurement, such as bar graphs, result readouts and various frequently used setup parameters (for example, *Meas. mode*). The template defines the content of this area. More than one screen can be used for displaying the information. Select the screen using the view tabs at the bottom of the View Area.

Changes made to the screens will only be applied temporarily, that is, until you select another project template or open another project to re-use the screen from that project. However, if you

want the screen changes to be saved in the current template, tap the Project Template Bar at the top of the screen to open the Template Explorer and tap the **Save** icon .

Note: If you make changes to the screen that you do not want to keep (and you have not yet saved the template), you can undo them by selecting the template again from the Project Template Bar at the top of the screen.

Shortcut Bar

The Shortcut Bar, at the bottom of the screen, displays a number of fixed icons that are always accessible. These include:

- **Main Menu** icon , giving access to the Main Menu. This allows you to navigate to a specific function, see description earlier under Navigation Principles
- **Backlight** icon , allows you to select a backlight level
- **Help** icon , a quick way to get context-sensitive help from any screen by tapping on the icon at the bottom. Closing the help window will return you to the previous screen
- **Battery/Power Status** icon , shows the condition of the battery. All green shows a fully charged battery, while red means power levels are low. Tap the icon to get more details of the battery condition. (When the power supply lead is connected, the icon will be displayed in place of the **Battery/power Status** icon .)

The clock in the lower right corner displays the current time. Tap the readout to get details of the time and date, or to set the clock.

4.4.3 Use of Pushbuttons for Controlling Measurements

The design of the analyzer is such that the layout of the pushbuttons has been optimised for single-handed operation.

Reset Measurement Pushbutton

Use the **Reset** pushbutton to reset a measurement, that is, to reset all detectors, averagers, maximum and minimum hold, etc. If the measurement is paused (the **Paused** icon ▮▮ is displayed in the Status Field), then the measurement reverts to a ‘stopped’ state after a reset, (the **Stopped** icon ■ is displayed with a zeroed readout). If the measurement is running, then the measurement will be automatically re-started after the reset.

Start/Pause Pushbutton

Use the **Start/Pause** pushbutton for controlling the measurement. The function of this key depends on the current measurement state (Table 4.1).

Table 4.1
Start/Pause pushbutton functions

Current Measurement State	Function of Start/Pause Pushbutton	Next Measurement State
■ Stopped	Start the measurement	▶ Running
▶ Running	Pause the measurement	▮▮ Paused
▮▮ Paused	Continue the measurement	▶ Running

Save Pushbutton

Use the **Save** pushbutton to save the measurement data together with the current project template (including all the screen settings and setup information) and the calibration documentation.

Pressing **Save** will affect the pause and running states. In both cases the measurement state will be 'stopped' shortly after pressing the pushbutton (**Stopped** icon ■ displayed).

Back-erase Pushbutton

For BZ-7222 and BZ-7223 Software:

Use the **Back-erase** pushbutton to erase the last 5 seconds completely from the measurement. (This includes, of course, overload indications you would like to erase.)

If used when the current measurement is running, then the measurement will be paused. The Status Field displays *Pause, Back erase* briefly, and then displays the shortened elapsed time along with the Paused icon ||.

For BZ-7224 and BZ-7225 Software:

Pressing the **Back-erase** pushbutton will start drawing an Exclude Marker on the display, see section 11.3.2. Pressing it again will stop drawing the marker on the display (toggle function).

4.4.4 On-screen Feedback and Traffic Light

Feedback is given on screen in the Status Field (Fig.4.2), and the Traffic Light indicates important states of the analyzer (Table 4.2).

Table 4.2
Traffic Light Indications

State	Light Scheme
During power-on or loading template	Nothing
■ Stopped. Ready to measure	Short yellow flash every 5 s
▶ Awaiting trigger, searching for calibration signal	Short green flash every second
▶ Running measurement, everything OK	Steady green light
|| Paused. Measurement not saved	Slow yellow flash on 1/2 s, off 1/2 s
▲ Overload	Fast red flash

4.4.5 Use of Stylus and Navigation Pushbuttons

The stylus and navigation pushbuttons are used for setting up the analyzer, navigating through the screens and managing the results.

A number of items that appear on the screen (parameter values or icons) can be selected, updated and activated. For instance, a new parameter value can be selected from a drop-down list.

The selection and activation of items on the screen can be done in two ways:

- Tapping once on the item on the screen will select and activate it, or
- Moving the field selector around using the navigation keys until the item you want is highlighted, then pressing the **Accept** pushbutton (✓) to activate it

You can choose to use the stylus or the pushbuttons, depending on your preference and the measurement situation. For instance, if the amount of noise generated by the analyzer needs to be kept to an absolute minimum, consider using the pushbuttons rather than the stylus – this is because tapping of the stylus on the touch-sensitive screen may create extra noise. However, if speed is of major importance, the stylus can navigate through the setup and measurement screens quicker.

Throughout the manual we have described how to perform the measurement procedures using the stylus only, but you may also use the alternative method (using the **Navigation** and **Accept** pushbuttons) if you prefer.

4.4.6 How to Change Parameter Values

Most parameter values are changed by selecting a new value from a drop-down list, which appears when the parameter field is selected. See the example in Fig.4.3.

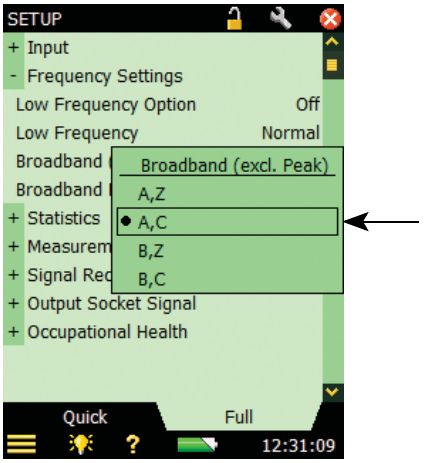


Fig.4.3
Changing parameter values

Stylus Usage

Tap the value you want in the drop-down, or tap outside the list to cancel the selection.

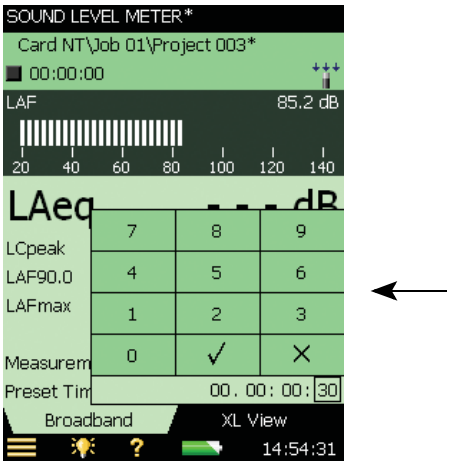
Pushbutton Usage

Use the Navigation pushbuttons (**Up Arrow** ▲, or **Down Arrow** ▼) to select the value you want and press the **Accept** pushbutton ✓ to activate it. Use the **Left Arrow** ◄ to cancel the selection.

Number Keyboard

When activating a number, a number keyboard appears (Fig.4.4).

Fig.4.4
Number keyboard

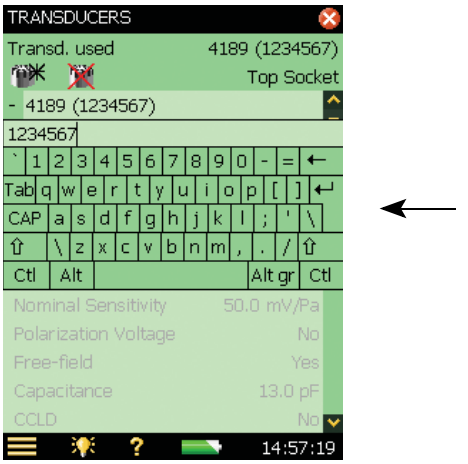


Tap the digits or use **Up Arrow** ▲**/Down Arrow** ▼ to increment/decrement the number. Use **Left Arrow** ◄**/Right Arrow** ► to select other digits if necessary. Press the **Accept** pushbutton ✓ or tap ✓ on the number keyboard to enter the number for the parameter. Tap × on the number keyboard, or outside the number keyboard to cancel the change of value.

Character Keyboard

When activating a text value, a standard full character keyboard appears on the screen (Fig.4.5).

Fig. 4.5
Character keyboard



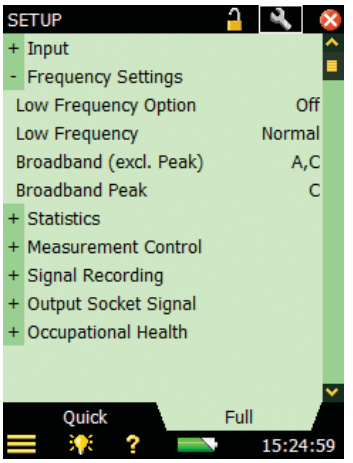
The character keyboard has all the functionality of a normal keyboard, enter text as required by tapping the individual keys with the stylus. Tap ↵ to accept the changes, or tap outside the keyboard to cancel.

4.4.7 How to Personalise your Setup

Setup contains all the settings for the measurement and some settings for post-processing.

Select *Setup* from the **Main Menu** , and the Setup screen appears (Fig. 4.6).

Fig. 4.6
The Setup screen – Edit Mode



The **Full** tab at the bottom of the screen allows you to view the complete list of setup parameters, while the **Quick** tab allows you to access the more frequently used parameters defined by yourself. Press the **Edit** icon on top of the screen to enter Edit Mode.

This mode allows you to copy parameters from the **Full** view to the **Quick** view simply by tapping on the parameters in the **Full** view – and to remove parameters from the **Quick** view by tapping on the parameters in the **Quick** view.

When you have finished, tap the **Edit** icon again to exit Edit Mode.

Setup settings can be protected from accidental changes by tapping the **Padlock** icon on the top of the screen. This will also protect the template from being deleted or renamed.

When locking the template you get the option of password protecting the lock. If you choose this, then you enter a password (see Fig.4.7).

Fig.4.7
Password protecting a template

The password must consist of minimum two characters and/or digits.

Note: The password is case-sensitive.

To unlock the setup settings and template, tap the padlock icon again. If the lock is password protected, you must enter the password.

Note: It is important to remember the password; the template cannot be unlocked without the password.

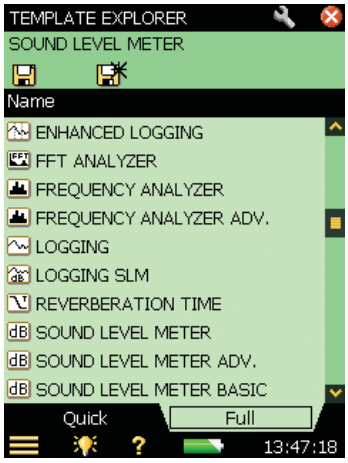
The only way of overwriting a locked template is to re-install the software using BZ-5503. The default templates will be overwritten by a standard installation. New or renamed templates can be deleted from BZ-5503.

4.4.8 How to Manage the Project Templates

The project templates containing all the display and measurement settings required to perform a measurement are selected in the Project Template Bar at the top of the Display screen (Fig.4.2).

You can save changes to the project template, create new templates, rename templates or delete templates from the Template Explorer screen. Select *Template Explorer* by tapping on the Project Template Bar at the top of the screen or from the **Main Menu**, and the screen shown in Fig. 4.8 will appear.

Fig. 4.8
Template Explorer



The topmost line in the Status Field ("Sound Level Meter" in Fig. 4.8) contains the name of the current template. If you make any changes to the settings in the current template, an '*' will appear next to the template name to indicate that the new settings have not been saved.

The next line contains icons for saving the settings. Tap the **Save** icon to save the settings in the current template.

Tap the **Save As** icon to save the settings in a new template. Use the keyboard that pops up to define the name of the template.

The rest of the screen is used for listing the defined templates with an icon, a template name and possibly an Annotations icon (paperclip):

1) Tap a template icon to open and use the template.

2) Tap a template name to get a drop-down list with the options:
   - *Open* (open and use the selected template)
   - *Clone* (create a copy of the selected template)
   - *Delete* (delete the selected template)
   - *Rename* (rename the selected template)
   - *Add Note* (or commentary) to the template
   - *View Annotations* on the template

3) Tap the **Annotations** (**Paperclip**) **Paperclip** icon to get the list of annotations attached to the project.

The **Full** tab at the bottom of the screen allows you to view the complete list of project templates, while the **Quick** tab allows you to access the more frequently used project templates. Press the **Edit** icon on top of the screen to enter Edit Mode.

This mode allows you to copy project templates from the **Full** view to the **Quick** view simply by tapping on a project template in the **Full** view – and to remove project templates from the **Quick** view by tapping on a project template in the **Quick** view.

When you have finished, tap the **Edit** icon again to exit Edit Mode.

Note 1: Annotations on templates are for describing the template and will not be copied to the project, when starting or saving a measurement.

Note 2: If you delete all templates of a certain type (for example, the Frequency Analyzer) and you want a template of this type again, then you either have to open a project made with this template and save the template, or you have to use Measurement Partner Suite BZ-5503 to transfer a template of this type to the analyzer.

4.4.9 Locking the Pushbuttons and Display

The pushbuttons and display can be locked to prevent inadvertent operation:

- **To Lock:** Select the *Lock Keys and Screen* option from the **Main Menu**
- **To Unlock:** Press the **Left Arrow** pushbutton ◄, followed by the **Right Arrow** pushbutton ►, then the **Accept** pushbutton ✓

If you attempt to press a pushbutton, or tap the screen, while the analyzer is locked, an information window pops up with instructions on how to unlock it.

Chapter 5

Calibration

5.1 Introduction

Calibration is an adjustment of your analyzer to measure and display correct values. The sensitivity of the transducer as well as the response of the electronic circuitry can vary slightly over time, or could be affected by environmental conditions such as temperature and humidity. While you are unlikely to ever experience a large drift or change in sensitivity with the analyzer, it is nevertheless good practice to perform regular calibrations, normally before and after each set of measurements. Often calibration is required by measurement standards, such as IEC 61672–1.

If you want your analyzer to remind you when the next Accredited/Traceable calibration is due, you can set it up on the **Reminder** tab of the Calibration screen. See section 5.9.

You can check the complete measurement chain during long-term measurement using Charge Injection Calibration. See section 5.10.

5.2 Acoustic Calibration

Acoustic calibration is the preferred calibration method when measuring with microphones, particularly when standards and regulations require calibration before a measurement. The method involves applying an acoustic signal of known magnitude and frequency to the microphone, which calibrates all the analyzer's components (microphone, preamplifier and electrical circuitry).

5.3 Sound Level Calibration

To perform acoustic calibration use Sound Calibrator Type 4231. It provides a stable sound pressure at 1 kHz and has minimal susceptibility to environmental factors. The procedure itself is relatively simple, and on the analyzer the procedure is referred to as the *Standard Calibration* procedure.

The procedure for performing an acoustic calibration and instructions on how to fit the calibrator are given in the following section.

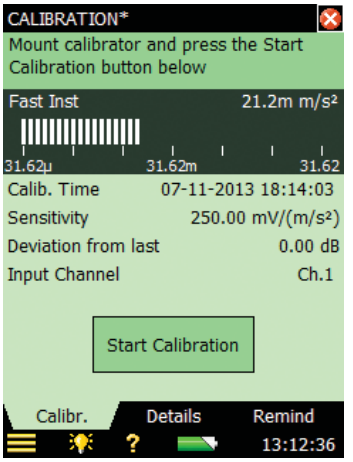
5.3.1 Standard Calibration

1) Stand away from loud sound sources that may interfere with the calibrator's signal.

2) Switch on the analyzer: push ⏻.

3) Tap the **Main Menu** icon ☰ then *Calibration* to open the Calibration screen (Fig. 5.1).

Fig. 5.1
Calibration screen



This screen contains a bar graph showing the actual sound pressure level and three placeholders for displaying information about the last calibration.

4) Following the first part of the instruction in the Status Field, fit Sound Calibrator Type 4231 carefully onto the microphone of the analyzer. (To avoid handling vibrations that disturb the calibration, rest the assembly in a roughly horizontal position on a table or other flat surface.)

   Ensure that the calibrator fits snugly on the microphone.

5) Switch on the calibrator. Wait a few seconds the level to stabilise.

6) Tap the Start button on the screen to start the calibration.

   Note: *Detecting level...* appears on the screen as feedback.

7) While the analyzer is searching for the calibration signal and the signal level is stabilising, the 'traffic light' indicates a short green flash every second. When the level is stable, the traffic light indicates a steady green and the signal is measured and used for calibration. **Once the calibration has been completed successfully, the traffic light indicates a short yellow flash every 5 seconds.** The *Sensitivity* is automatically calculated and displayed in a pop-up together with the deviation from the last calibration. Press *Yes* to accept and use the new sensitivity and save it in the calibration history. Press *No* to disregard the new calibration and continue with the old calibration.

   If the calibration deviates more than ± 1.5 dB from the initial calibration (microphones only), then the calibration is stopped without changing the calibration of the analyzer. The traffic

light will indicate a fast flashing red and an error description will appear in the Status Field.

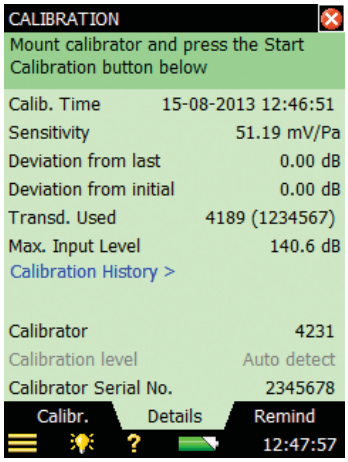
Hint: If the microphone is separated from the analyzer using a microphone extension cable then place the analyzer so it can be seen from the location of the microphone. Start the calibration process (select the Calibration screen and tap the Start button on the screen), then go to the microphone and fit the Calibrator onto the microphone, switch on the Calibrator and monitor the traffic light on the the analyzer, as discussed previously.

8) Once you have completed the calibration, tap the Exit button and remove the calibrator. It will automatically switch off after a few seconds.

5.3.2 Calibration Settings

Select the *Details* tab on the Calibration screen to view the calibration details (Fig. 5.2).

Fig. 5.2
Calibration details screen



This screen displays the following information:

- Details of the last calibration: date, sensitivity, deviation from last calibration and deviation from initial calibration
- The connected transducer: type and serial number

  Note: You select a new transducer by tapping on the **Main Menu** icon and selecting *Setup*, followed by *Input*)
- *Max. Input Level*: The maximum sinusoidal input level to be measured without overload indication
- A *Calibration History* link, which is provided to enable you to view a history of transducer and calibration settings, see below

The calibration settings can be adjusted as follows:

- *Calibrator*: Select between Type 4231 and a custom calibrator
- *Calibration Level*: Enter the specific level of your custom calibrator. If you are using, Type 4231, calibrator level is automatically detected, (shown as *Auto detect*)

Note: The *Auto detect* setting enables the automatic detection of the calibration level. For free-field microphone types (like Types 4189 and 4190) the calibration level from Sound Calibrator Type 4231 is either 93.85 dB or 113.85 dB. For diffuse- or pressure-field types, the calibration level is either 94 dB or 114 dB. The calibration process automatically determines the correct level

- *Calibrator Serial Number*: Type in the serial number for your calibrator. The calibrator will be documented in the calibration history

5.4 Vibration Calibration

To calibrate an accelerometer use Calibration Exciter Type 4294. It provides a stable acceleration of 10 m/s^2 at 159 Hz. The procedure for mounting the accelerometer to the exciter is described in the Type 4294 user manual. Otherwise the calibration procedure is very similar to the Standard Calibration procedure for sound calibration described above. However, if the calibration deviates more than ± 5.5 dB from the nominal sensitivity, the calibration is stopped without changing the calibration of the analyzer. In this case, check whether the correct accelerometer has been selected from the transducer database and whether it has the correct nominal sensitivity.

Note: If you use Low Level Accelerometer Type 8344, you need Calibration Exciter Type 4294-002.

5.5 Electrical Calibration

To calibrate the Direct input use a stable sinusoidal voltage at a frequency between 150 Hz and 10 kHz. The procedure is very similar to the Standard Calibration procedure for sound calibration described above; however, without the transducer mounting procedure.

5.6 Manual Calibration

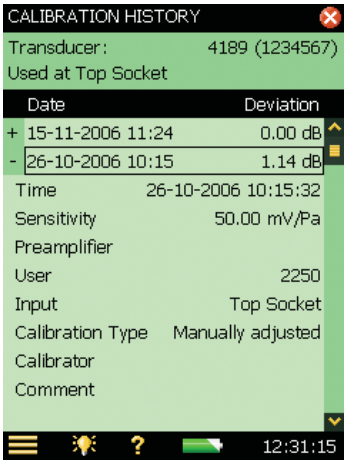
If no calibrator is available (or a known amplification is introduced, that is, by analyzing a tape recorded signal) then you can type the sensitivity directly into the *Sensitivity* field. The analyzer will be regarded as un-calibrated and the text '*Uncal.*' will appear in the Status Field.

5.7 Calibration History

To view calibration history, tap *Calibration History* > on the Calibration Details screen (Fig. 5.2).

The analyzer saves the last 20 calibrations, plus initial calibration, which can be viewed on the Calibration History screen (Fig. 5.3). Tap to return to the calibration details screen; tap again to return to the Measurement screen.

Fig. 5.3
Calibration History screen

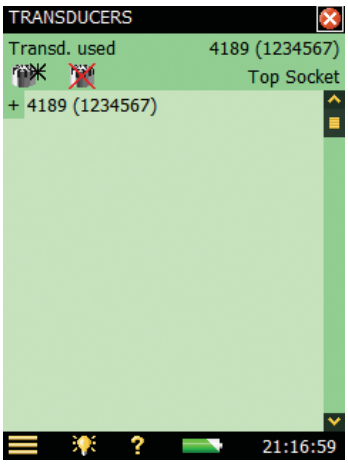


5.8 Transducer Database

The specifications for Microphone Types 4189 and 4190 (and Preamplifier ZC-0032), which come fitted in the top socket of the analyzer, are described in a transducer database.

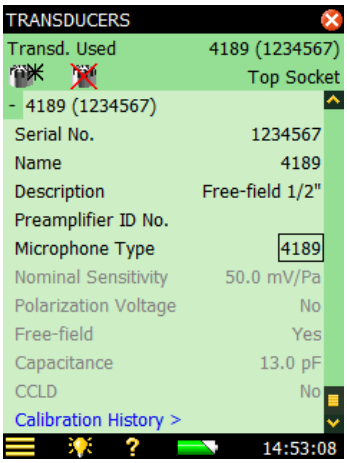
1) Tap the **Main Menu** icon then *Transducers* to open the Transducer Database screen (Fig. 5.4)

Fig. 5.4
Transducer Database screen



2) Tap the transducer name/number, or select the **Plus** icon + next to name/number, to view the details in the database (Fig. 5.5).

Fig. 5.5
Details in the Transducer Database



All the details for the currently selected microphone can be found in the database. You can add other transducers by tapping on the **Add New Transducer** icon , selecting *Microphone*, *Accelerometer* or *Direct* input from the drop-down, and filling in the details of your particular transducer parameters. See section C.2.1. This is done by selecting the item from the drop-down list that appears on some parameter fields, or by entering the data via the keyboard that appears on other parameter fields.

When adding a new microphone, Type 4189 is the default entry. Change *Microphone Type* to fit your microphone. For known microphone types, a number of parameters are automatically set.

Note 1: If the transducer is a microphone and the microphone type is known to the analyzer (as in the example in Fig. 5.5, where Type 4189 details are known), then the parameters *Nominal Sensitivity, Polarization Voltage*, *Free-field*, *Capacitance* and *CCLD* are set automatically. See details in Appendix C. The analyzer can then make sound field correction and windscreen correction as specified in the setup. To confirm which type of correction is being applied, an icon is displayed in the measurement Status Field, as described on section 4.4.2. If the microphone is unknown to the analyzer, no corrections can be made and no icon appears in the Status Field. The parameters mentioned above have to be set manually (that is, typed in). We recommend that you insert the value for *Nominal Sensitivity* directly from the calibration chart. Nominal sensitivity is used in the automatic level detection calculations, when calibrating using Sound Calibrator Type 4231, to determine whether the level is 94 or 114 dB.

Note 2: If the transducer is an accelerometer and the accelerometer type is known to the analyzer, then the parameters *Nominal Sensitivity, CCLD* and *Weight* are set automatically.

In the top line of the Status Field you can select which transducer is currently connected to the analyzer. This can also be done via the Setup screen by selecting *Input,* then selecting the transducer in the *Transducer* field.

In the first line of the Status Field you can select whether the transducer is connected to the Top Socket or the Rear Socket of the analyzer. This can also be done via the Setup screen by selecting *Input*, then selecting the socket in the *Input:* field.

For Type 2270 only: In the second line you also have a *Channel Selector.*

To change which input the transducer uses to connect to the analyzer, tap the **Main Menu** icon and select *Setup* from the list, next tap the *Input* value field and finally, choose the required input from the drop-down list: *Top Socket* or *Rear Socket* (*Rear Socket* refers to the Input socket on the connector panel of the analyzer).

At the bottom of the parameter list you can select the calibration history for the currently selected transducer by tapping on the *Calibration History* link. See section 5.7 and Fig. 5.2.

You can delete a transducer by tapping on the **Delete Transducer** icon and selecting the transducer to delete from the drop-down that appears.

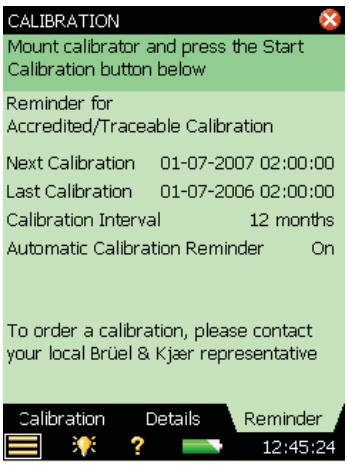
Note: Only transducers that are not connected can be deleted. The calibration history will also be deleted.

When you have finished, tap to return to the Measurement screen.

5.9 Calibration Reminder

The Calibration **Reminder** tab (Fig. 5.6), allows you to keep track of when you need to run your next Accredited/Traceable calibration, and shows you the date of your last calibration.

Fig. 5.6
Calibration Reminder tab

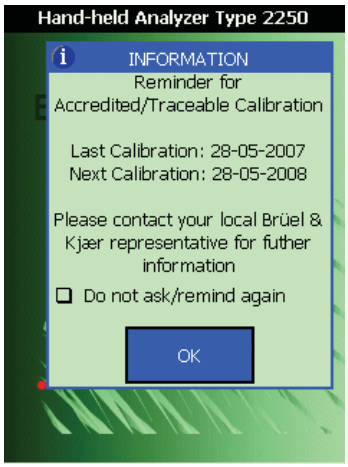


The automatic calibration reminder facility will pop-up a reminder approximately two months before your next calibration and keep on reminding you every week until you do one of the following actions:

- Send your analyzer for Accredited/Traceable Calibration and update the *Last Calibration* date
- Check the '*Do not ask/remind again*' checkbox in the reminder pop-up
- Disable the automatic calibration reminder

An example of a reminder pop-up is shown in Fig. 5.7:

Fig. 5.7
Reminder pop-up



You can set the *Calibration Interval* parameter to either *12 months* or *24 months* depending on your local requirements.

You can disable the facility by selecting the *Automatic Calibration Reminder* parameter to *Off*.

5.10 Charge Injection Calibration

5.10.1 Theory of CIC

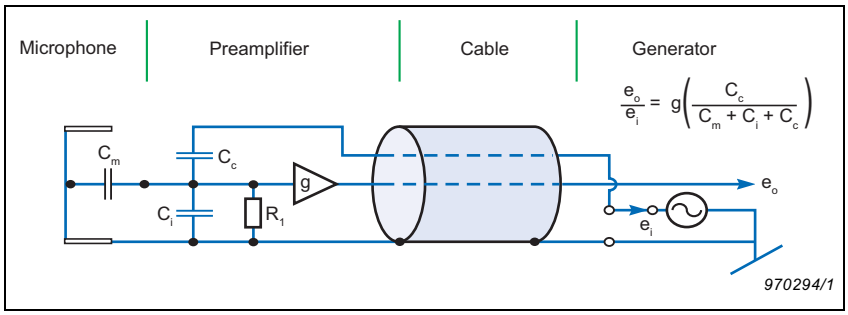
If an external sound source is not available, for example during short or long term monitoring, you can check the calibration of the analyzer using the Charge Injection Calibration (CIC) facility. This is done automatically during a logging measurement (see section 11.2 and section 12.2). Unlike an internal calibration, the Brüel & Kjær patented CIC technique enables a complete measurement chain to be verified, including the microphone, preamplifier, cabling and analyzer. Each verification measurement is compared to an initial reference measurement.

As the name implies, the CIC method injects an internally generated charge into the microphone and preamplifier input circuit, and the ratio between the measured signal and the injected signal is measured (CIC Ratio; Fig. 5.8).

This method is based on the detection of changes in impedance at the input terminal. It was developed for monitoring of microphone channels and requires a preamplifier with a small, extremely stable built-in capacitor, which enables the application of an electrical signal to a preamplifier (and microphone) input terminal.

A stable CIC Ratio means a ‘healthy’ system and assures stable operation of the microphone, cable, preamplifier and remaining measurement system.

Fig. 5.8 *Charge Injection Calibration. Low-leakage resistance capacitor C_c is set in parallel with the microphone and fed with voltage e_i. The ratio e_o / e_i is constant when g, C_c, C_m and C_i are constant. Changes to preamplifier gain (g), cable parameters, microphone capacitance (C_m), etc., will change e_o / e_i and, hence, indicate probable changes in calibration*



5.10.2 Performing a Manual CIC with your Type 2250/2270

CIC is only available for microphones connected to the Top Socket of the Analyzer and with Logging Software BZ-7224 and Enhanced Logging Software BZ-7225.

Tap the **Main Menu** icon and select *Calibration* from the list. Click the **CIC** tab to view the various CIC parameters that are available. The available parameters will include the results of the latest manual CIC, together with the reference (Fig. 5.9).

The Status Field at the top of the screen informs you how to perform the CIC.

Press the **Start CIC** button to start the CIC. After approximately 10 sec you will see the result.

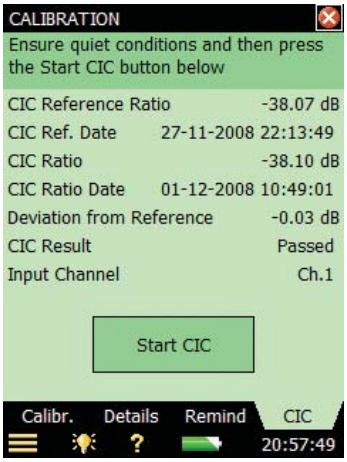
Normally, the *CIC Reference Ratio* is set the very first time a CIC is performed, however, you should update the *CIC Reference Ratio* if you change the microphone preamplifier. You do this by checking the *Use as new Reference* checkbox.

The *CIC Reference Ratio* and *CIC Ref. Date* parameters display the results of the very first manual CIC, and this will be used as the 'reference' for all subsequent CIC Ratio measurements.

Note: Each microphone in the transducer database has a CIC Reference Ratio.

If the *CIC Ratio* parameter deviates by more than 0.5 dB from the *CIC Reference Ratio*, there may be a problem, and it should be investigated, see page 60.

Fig. 5.9
CIC *tab*



The result of the Charge Injection Calibration consists of four parameters:

- *CIC Ratio*
- *CIC Ratio Date*
- *Deviation from Reference*
- *CIC Result*

The *CIC Result* can be either '*Passed*', '*Background noise too high*' or '*CIC Ratio deviates from Ref.*'

Chapter 6

Data Management

6.1 Organising Measurements

6.1.1 Description of Jobs and Projects

When saving a set of measurement results, they are organised together with setup information, calibration information, annotations and signal recordings in a project.

A project contains the following:

- Measurement results:
  - Broadband values (for example, L_{Aeq}, L_{AFmax}, L_{AFmin}, etc.)
  - Frequency spectra (if Frequency Analysis Software BZ-7223 is enabled on your analyzer and you have selected a Frequency Analyzer template)
- Weather and GPS data
- Measurement Setup
- Display Setup (parameters you have selected)
- Information on the microphone
- Calibration
- Annotations – Commentary (attached to measurements as required)
- Annotations – Text, notes or GPS notes (attached to measurements as required)
- Annotations – Image (attached to measurements as required) – Type 2270 only
- Signal Recordings (attached to measurements as required)

The project name is automatically created by combining the Project Name Prefix with a number (starting from 001),that is, PROJECT 001 for the first project, PROJECT 002 for the next, etc.

If preferred, the Project Name Prefix can be changed from the default name of ‘Project’. To do this, tap the **Main Menu** icon , then *Preferences* followed by *Storage Settings* to reveal the Project Name Prefix. Tap the current name to reveal a keyboard for you to type in the required name.

Projects are saved in folders which are called ‘jobs’ on your analyzer. These are similar to folders in the Microsoft® Windows® filing system.

Jobs can be created:

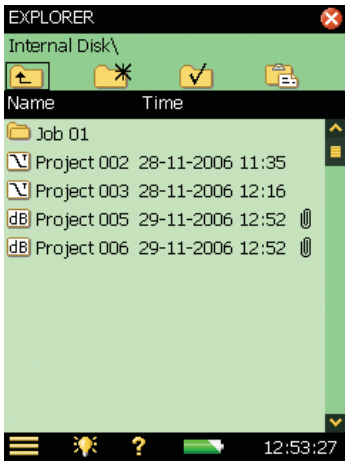
- in the internal memory
- on a Secure Digital (SD) card
- on a USB memory stick (hardware version 4 only)
- on a Compact Flash (CF) card (hardware versions 1 – 3 only)

6.1.2 Navigating in Jobs

On the analyzer, a results browser called **Explorer** is used to navigate through the jobs and projects.

To view all jobs and projects, tap the **Main Menu** icon and select *Explorer* from the list of options – or simply tap the project name on the Measurement screen. A screen similar to Fig. 6.1 will appear.

Fig. 6.1
The Explorer screen



The example from **Explorer** in Fig. 6.1 displays a list of jobs and then some projects that have not been stored under a job name.

The topmost line in the status area (*INTERNAL DISK* in the example in Fig. 6.1) shows the location in the memory.

The next line in the status area contains four icons for navigation.

Tap the icon to go up one level in the job levels. The top level is the Memory level, where physical memory devices can be selected. You can select:

- **With Hardware Versions 1 – 3:**
  - *Internal Disk*
  - *SD-Card* (if a card is inserted in the SD slot)
  - *CF-Card* (if a card is inserted in the CF slot)
- **With Hardware Version 4:**
  - *Internal Disk*
  - *SD-Card B* (if a card is inserted in the bottom SD slot)
  - *SD-Card T* (if a card is inserted in the top SD slot)
  - *USB-Mem* (if a memory stick is inserted in the USB Standard A socket)

If *Multi User* is enabled (see section 8.1.6), then each user can access data on any of the devices. However, a user cannot see or access jobs for other users.

To go down one level (that is, exit the Memory level), you tap the job name (*INTERNAL DISK*\ in this case) and select *Open* from the drop-down list – or you simply tap the **Memory** icon next to *INTERNAL DISK*\.

Tap the icon to create a new job folder. The first job folder name will be ‘JOB 01’, subsequent job folders will be labelled ‘JOB 02’, ‘JOB 03’, etc. You can rename the job folder name by tapping on the name and selecting *Rename* from the drop-down list. Use the keyboard to key in a new name – accept by tapping on the **Enter** key .

To go down one level (open a job), you tap the job name in the list and select *Open* from the drop-down list – or you simply tap the **Job** icon to the left of the job name.

You can move a job/project (and its content) to another job by tapping the job name/project name and selecting *Cut* from the drop-down list. Then navigate to the job you want as the new holder of the moved job/project and tap the **Paste** icon , or navigate to the level above and tap the job name and select *Paste* from the drop-down list.

In order to copy a job/project, do as described above, but use *Copy* instead of *Cut* from the drop-down list.

Select *Delete* from the drop-down list in order to delete the job/project and all of its contents.

You can select more than one job/project for *Copy*, *Cut* or *Delete* by tapping and holding the stylus on a job/project name and then dragging the stylus up or down to select other jobs/projects.

6.2 Selecting Default Measurement Job/Path

Tap the icon to select the current job as the default measurement job, where all projects will be saved when you press the **Save** pushbutton. The job name, followed by the current project name, will appear in the topmost line in the status area to confirm which job you have selected.

6.3 Recalling Measurements

You can recall your measurement results to display the measured results, re-use setups from previously saved projects or view logged data as a profile. Use the *Open* command in Explorer – this will recall the project template (display settings and measurement setup used on the saved results) along with the results. This will, however, stop and reset the current measurement

6.3.1 Viewing Data and Re-using Setups from Projects

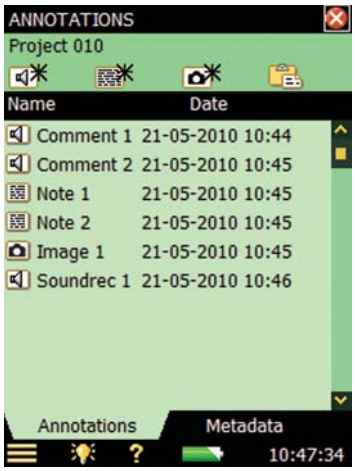
Use **Explorer** to locate the project with the setup you want to re-use, then tap the project name and select *Open* from the drop-down that appears. This will stop and reset the current measurement and load the project including all setups and data. You are now using the same screens as the ones you were using just before you saved the data. Use the screens to browse the results. Pressing **Start/Pause** will start a new measurement using the setups from the project.

You can save the setup information in a template by tapping the Template Bar at the top of the screen, see section 4.4.8.

6.3.2 Viewing or Listening to Annotations and Metadata

Use Explorer to locate the project with the annotations you want to view/hear, then tap the project name and select *Annotations* from the drop-down that appears (or simply tap the **Annotations** icon) and select the **Annotations** tab. This will show all annotations attached to the project (Fig.6.2.)

Fig.6.2
Example of an annotation attached to a project



The icon represents a verbal annotation, or commentary. Tap the annotation name and select *Play* from the drop-down that appears (or tap the icon) to play the commentary using the headphone output.

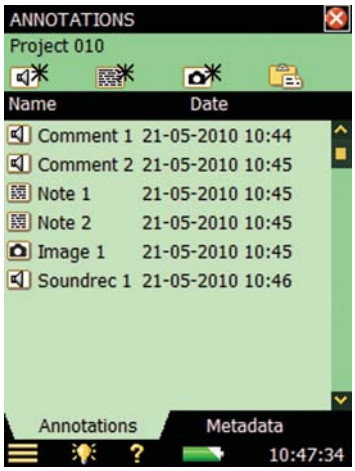
Note: You can also rename or delete annotations, or copy or move annotations to other projects or jobs.

The **Text** icon represents written annotations, or notes. Tap the annotation name and select *Open* from the drop-down that appears (or tap the icon) to open the **Notes** editor. View the comments and, if required, edit the comments using the simulated keyboard that appears at the bottom of the screen. Tap the icon to accept the changes and return to the previous screen.

The **Image** icon represents image annotations. Tap the annotation name and select *Open* from the drop-down that appears (or tap the icon) to open the **Image** viewer. Tap the icon to return to the previous screen.

Select the **Metadata** tab to see all metadata attached to the project (Fig. 6.3). You can change the metadata just by tapping on them and entering new values. You can also edit the settings for the metadata and reuse specific metadata on new projects by tapping on the **Edit** icon for the specific metadata (further information in section 8.7).

Fig. 6.3
Example of metadata



Inserting Annotations Using Explorer

In addition to inserting commentary, text or image annotations on your current measurement, see section 3.5, you can insert commentary, text or image annotations on projects or jobs using **Explorer**.

Tap a job or project name and select *Add note*, *Add Comment* or *Add Image* (Type 2270 only) from the drop-down that appears.

Chapter 7

Connection to PC or Smart Phone

7.1 Introduction

You can connect to your analyzer from a PC or smart phone in a number of different ways using a wide range of different connection types:

- Use Measurement Partner Suite BZ-5503 for full control of the analyzer – see section 7.2
- Use an Internet browser for online display and control of the analyzer – see section 7.4

Two different methods are available for connecting to the analyzer:

- USB: BZ-5503 connects to the analyzer through a USB cable
- Network: The analyzer is connected to a network (local or Internet) via a modem, LAN cable or a wireless LAN adaptor. BZ-5503 or an Internet browser will then be able to connect to the analyzer through TCP/IP using the analyzer's (global) IP address

In addition to connecting to the analyzer, the analyzer itself can notify you by SMS or email, based on various conditions. For more information, see section 8.4.

Table 7.1 gives you an overview of the different connection possibilities including links to relevant chapters with more details.

Table 7.1 *Connection overview*

Connect from	Connection Type	Settings in Preferences	Available Notifications
BZ-5503	USB	Modem = *Disabled* see section 8.2	–
BZ-5503, Internet Browser or Smart Phone with Internet Browser	Network or GPRS/EDGE/HSPA Modem	Modem = *GPRS/EDGE/HSPA Dialup* Settings in Dialup Networking Network Settings Possibly settings in DynDNS see sections 8.2 and 8.3	Email see section 8.4
BZ-5503, Internet Browser or Smart Phone with Internet Browser	Network Ethernet cable	Modem = *Disabled* Possibly settings in DynDNS Network Settings see sections 8.2 and 8.3	Email see section 8.4
BZ-5503, Internet Browser or Smart Phone with Internet Browser	Network CF WLAN (hardware versions 1 – 3 only) SD WLAN (G4 only)	Modem = *Disabled* Possibly settings in DynDNS Network Settings Settings in Wireless Network see sections 8.2 and 8.3	Email see section 8.4
BZ-5503, Internet Browser or Smart Phone with Internet Browser	Network DSL Modem/Router	Modem = *Disabled* Possibly settings in DynDNS Network Settings see sections 8.2 and 8.3	Email see section 8.4

Note: The online help for BZ-5503 contains additional information on how to connect an analyzer using the different connection types.

7.2 Transferring Measurement Data to Your PC

Measurement Partner Suite BZ-5503 is used for communication between your PC and the analyzer. You can use this software to:

- Transfer measurement data and templates from the analyzer to your PC, and vice versa
- View data
- Organise data on the analyzer
- Create users on the analyzer
- Upgrade software on the analyzer
- Install software licenses on the analyzer

Using this software, measurements on the analyzer can be controlled from your PC and displayed online, using the same user interface on the PC as on the analyzer.

Data transferred to the PC are organised in Archives. You can view the measurement data in the Archives.

7.2.1 Connect to Your PC

Connect the analyzer to your PC using one of the following:

- Hardware versions 1 – 3:
  - The supplied Mini USB Cable AO-1476
  - A modem connection
  - A LAN connection using a LAN cable (Type 2270 only)
  - A LAN connection via CF card adaptor
- Hardware version 4 (G4):
  - The supplied Micro USB Cable AO-1494
  - A modem connection
  - A LAN connection

The connection can be protected by requiring a login with user name and password – see settings in section D.11. See Chapter 8 for descriptions on how to set up your preferences, including PC connections.

7.3 Post-processing and Reporting

Use the optional modules of the Measurement Partner Suite for data analysis and post-processing. For example, data in the archives can be post-processed directly in the Logging Post-processing Tools BZ-5503-A module or Spectrum Post-processing Tools BZ-5503-B module. Furthermore, data can be exported to to various post-processing tools like Evaluator™ Type 7820 for assessing environmental noise; Protector™ Type 7825 for assessing workplace noise; Qualifier™ Light Type 7831 for documenting reverberation time measurements; or Microsoft® Excel®.

Signal recordings can be imported to Brüel & Kjær's PULSE™ Multi-analyzer platform for further analysis.

For more information on Measurement Partner Suite BZ-5503 and the PULSE multi-analyzer platform, see our website at www.bksv.com or contact your local Brüel & Kjær representative.

For further information on post-processing and reporting capabilities, please refer to the on-line help included with the relevant PC software. This software is supplied on the Environmental Software DVD (BZ-5298) included with your analyzer.

7.4 Internet Browser for Online Display and Control of the Analyzer

When the analyzer is connected to a network (see Fig. 7.1) you can connect to the analyzer from a PC or smart phone using an Internet browser supporting JavaScript®.

Analyzer Settings

You access preferences by tapping on the **Main Menu** icon and selecting *Preferences* from the list of options (the screen shown in Fig. 8.1 will appear).

Tap *Remote Access Settings*, or select the **Plus** icon + next to *Remote Access Settings* and set the *Web Server* parameters to *Enabled.* Define sets of *Usernames* and *Passwords*:

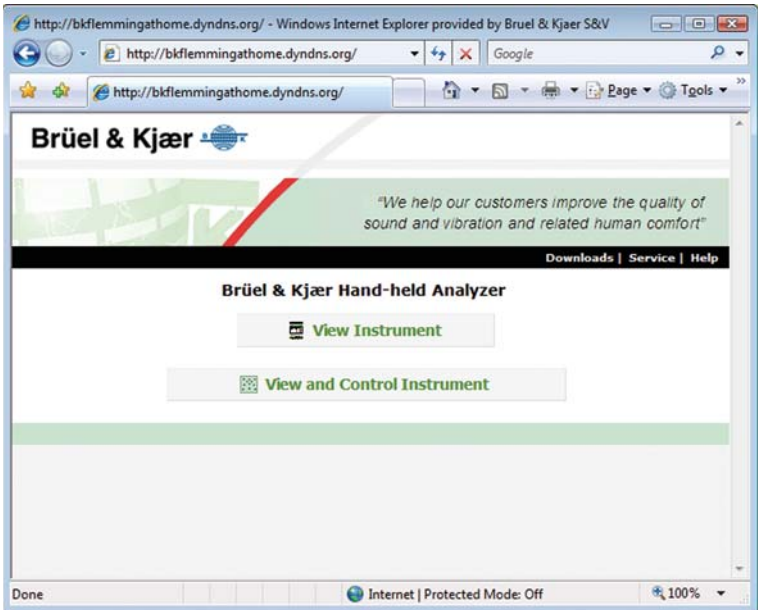
- one set for guest use (view only)
- one set for administrator use of the analyzer (view and full control)

See section 8.5 and section D.11 for more details.

Connect to Analyzer

When you enter the *IP address* or *Hostname* of the analyzer (see sections 8.2. and 8.3) in the address or location bar of the Internet browser, the following screen appears:

Fig. 7.1
2250 home page



Click the **Help** link to get more detailed help on using the web page.

Click the **Service** link for updating the software or for rebooting the analyzer.

Click the **View Instrument** button to enter the web page for viewing the analyzer only. You might be prompted for the *Guest Username* and *Guest Password* defined for the web server (see section 8.5).

Click the **View and Control Instrument** button to enter the web page for full access to the analyzer. You will be prompted for the *Username* and *Password* defined for the web server.

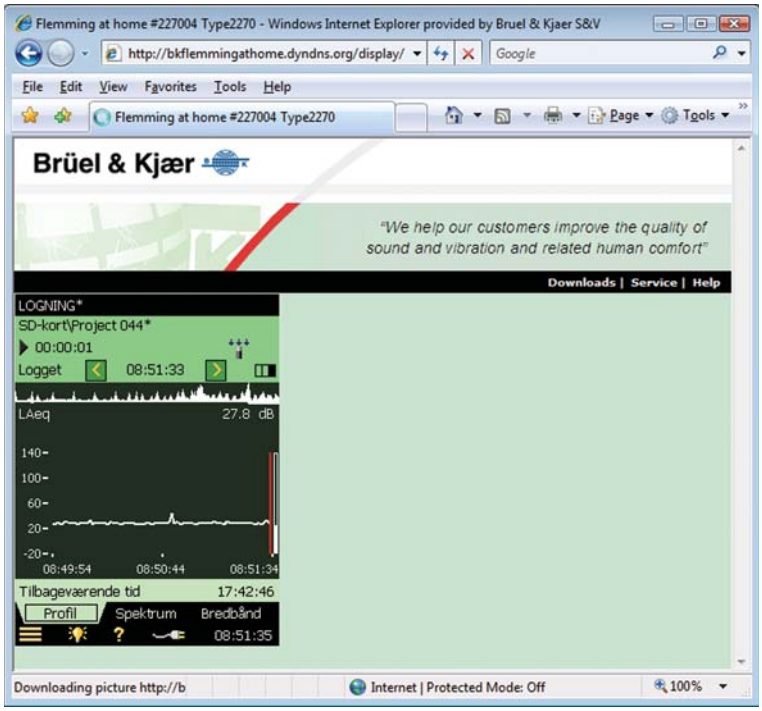
Fig. 7.2
Prompt for username and password

Connect to 192.168.0.150
The server 192.168.0.150 at B&K-Analyzer requires a username and password.
Warning: This server is requesting that your username and password be sent in an insecure manner (basic authentication without a secure connection).
User name:
Password:
Remember my password
OK
Cancel

The View Instrument Web Page

Fig. 7.3 shows the **View Instrument** web page, where you have an online display of your analyzer. You can use the online display for monitoring the measurement only, you cannot change the display, or setup parameters, or start and stop measurements, etc.

Fig. 7.3
Online display for monitoring only



The analyzer can be viewed by several people at the same time, however, the response time will increase with the number of connected browsers.

The View and Control Instrument Web Page

Fig. 7.4 shows the **View and Control Instrument** web page, where you have an online display and keyboard for full control of the analyzer. The online display can be used for monitoring the measurement.

The keyboard on the screen has the same functions as the analyzer's keyboard. Click on the display with the cursor to control the analyzer as you do when tapping on the analyzer display.

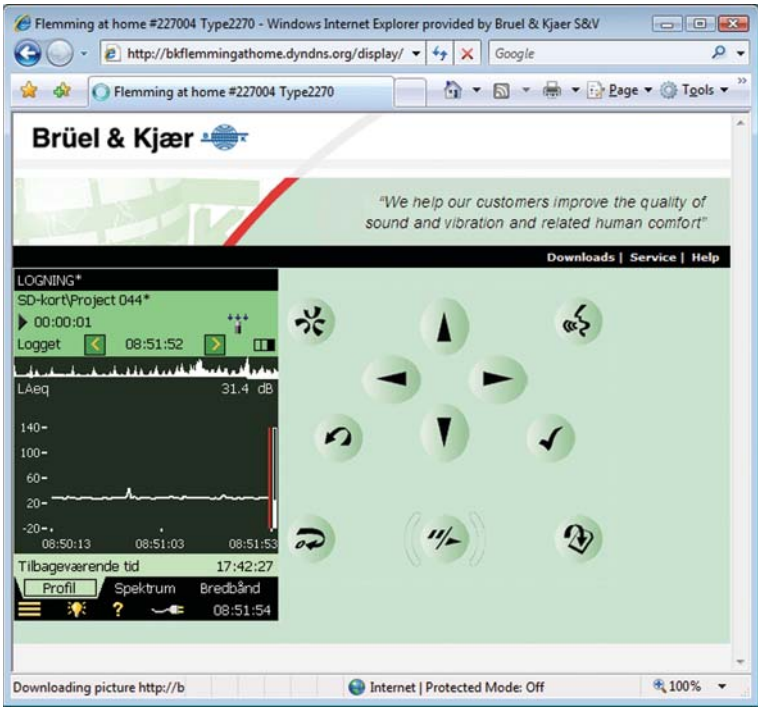


Fig. 7.4
Online display and keyboard for full control of the analyzer

Chapter 8

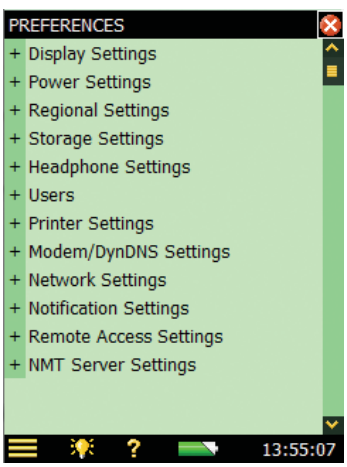
Advanced Use of the Analyzer – Tips and Tricks

8.1 Setting your Preferences on the Analyzer

You can specify a number of parameters controlling display settings, power settings, regional settings, storage settings and users. These parameters are grouped together under *Preferences*.

You access preferences by tapping on the **Main Menu** icon and selecting *Preferences* from the list of options. The screen shown in Fig.8.1 will appear.

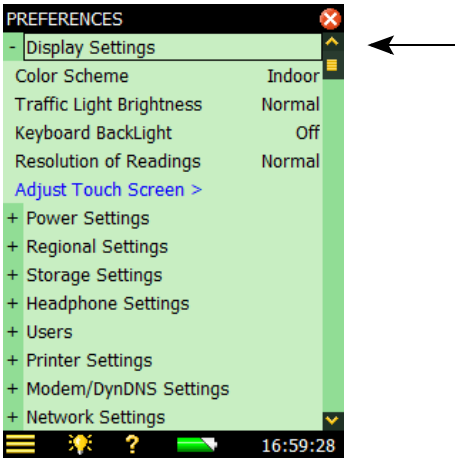
Fig.8.1
The Preferences screen



8.1.1 Display Settings

Tap *Display Settings*, or + next to *Display Settings*, to expand the list of available display settings (Fig.8.2). These parameters allow you to select a suitable display colour scheme. This may vary, depending on the lighting conditions at the time of the measurement.

Fig.8.2
Display Settings screen



The colour schemes are:

- *Indoor* scheme – for everyday use
- *Alhambra* and *Arcade* schemes – alternative colour schemes for everyday use
- *Outdoor* scheme – for very bright conditions, where you need as much contrast as possible
- *Night* scheme – for measuring under very dark conditions, where is needed night vision

For each colour scheme, you can select the optimum choice of brightness for the traffic light (for example, *High* for *Outdoor* in bright light conditions and *Low* for *Night* in dark conditions) and whether to have backlight on the keyboard. In very bright lighting conditions you will not be able to see the backlight, set it to *Off* to save some power.

A link is also provided in *Display Settings* to adjust the touch-sensitive screen. Tap *Adjust Touch Screen >* to display a full screen with guidance on how to tap a cross five times at different places on the screen. At the end of the adjustment procedure you can save the values or cancel the adjustment.

To change the number of decimal places on your dB results readout between 1 and 2 decimal places, or to change the number of digits on your engineering units readout between 3 to 4 digits, tap *Resolution of Readings* and set to *Normal* or *Extended*, as required. This setting is for display only and has no effect on the measurement precision or resolution.

Tap *Display Settings*, or - , to collapse the list.

8.1.2 Power Settings

The analyzer has an advanced power management function that takes care of supplying the different circuits with adequate power and switches off circuits that are not in use. These power management functions can be changed via the Power Settings screen (Fig.8.3).

Tap *Power Settings*, or + next to *Power Settings*, to expand the list of power settings:

- *Backlight Dim*
- *Standby*
- *Turn off Backlight* (only with hardware versions 1 – 3)
- *Ext. Power* (only with hardware version 4 (G4))

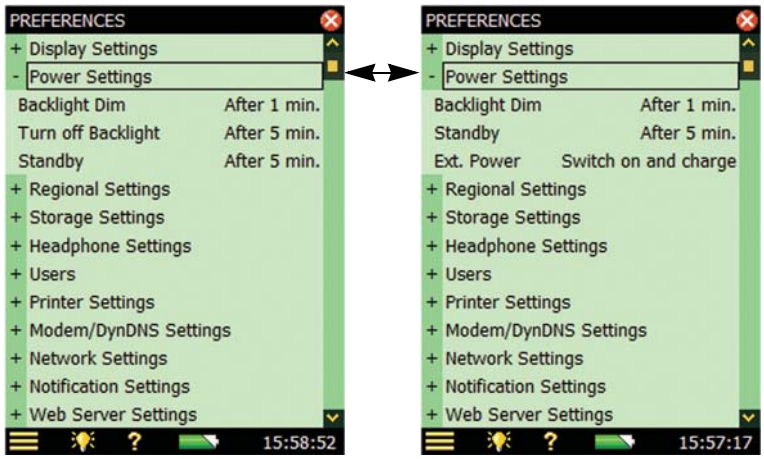


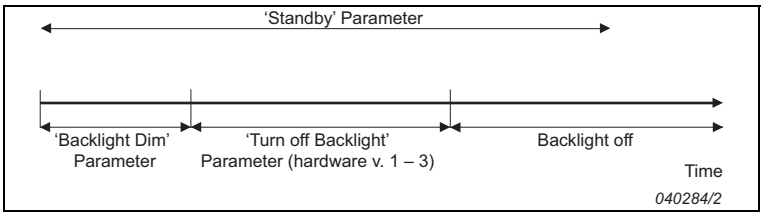
Fig.8.3
Power Settings screen
Left: *For hardware versions 1 – 3*
Right: *For hardware version 4*

The backlight will be switched on as soon as you operate the analyzer, either by using the keyboard or stylus on the touch-sensitive screen. The backlight brightness will be one of the six levels set by tapping at the bottom of the screen. Select *Minimum* for minimum brightness and (power consumption), and *Maximum* for maximum brightness and (power consumption). Once you have chosen the level, select *Close* to save the settings.

When the analyzer has been left unused for the time specified in the *Backlight Dim* parameter, the backlight level will change to the dim level (*Minimum*):

- For hardware versions 1 – 3, this state will hold for the time specified in the *Turn off Backlight* parameter (if still left unused). If the analyzer has been left unused for the time specified in the *Backlight Dim* parameter plus the *Turn off Backlight* time period, then the backlight will be switched off completely (Fig.8.4). Use the keyboard or tap the screen to switch the backlight on again
- For hardware version 4, the backlight will never be switched off completely because the *Minimum* dim level already has the lowest power consumption

Fig.8.4
Power Settings overview



If the analyzer is left unused, not measuring and not communicating over the USB interface, it will go to Standby after the time specified in the *Standby* parameter. If in Standby mode, you must press ⏻ to switch the analyzer on again.

The analyzer will automatically switch off when it has been in Standby mode without external power for more than 30 hours.

Note 1: If the analyzer is powered externally, the *Standby After* parameters are ignored and the analyzer will never go to Standby. However, if the analyzer is left unused for more than *Standby After* time, the *Standby After* setting will overrule the *Backlight* settings and the backlight will be switched off or dimmed.

Note 2: Please use the *Display Settings* in conjunction with the *Power Settings* to save power during measurements and extend the battery operating time.

Hardware version 4 (G4) has an *Ext. Power* setting, which determines whether the analyzer automatically switches on and charges the battery when external power is applied or the battery is just charged. It is recommended to select the *Switch On and Charge* setting for unattended measurements, to ensure measurement will restart in case of power failure.

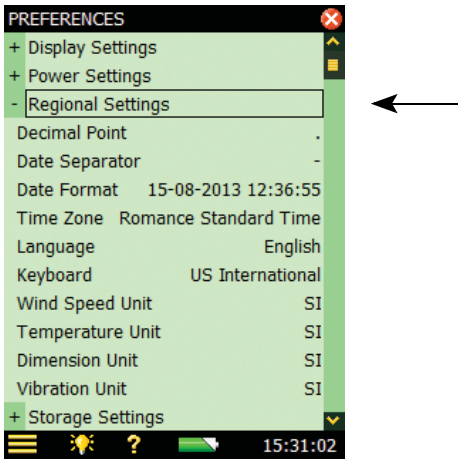
Hardware versions 1 – 3 have a similar function. There is a small, manual switch at the back of the analyzer, under the battery pack. To access the switch, remove the battery.

When you have made your choices, tap *Power Settings*, or -, to collapse the list.

8.1.3 Regional Settings

Tap *Regional Settings*, or + next to *Regional Settings*, to expand the list of available regional settings (Fig.8.5).

Fig.8.5
Regional Settings screen



Select your preferred settings for *Decimal Point* and *Date Separator* and select your preferred *Date Format* (date and time) from the six different formats provided in the drop-down. Then select your *Time Zone* from the list.

A number of different languages are available for your analyzer. Select your preferred *Language* – if it is not in the list, then it might be available for installation using BZ-5503 (Harware version 1 – 3 only).

Built-in help is provided in the more commonly used languages – if your particular language is not covered, English will be chosen automatically.

Select a *Keyboard* matching the one you prefer when using your PC.

Select the unit system for *Wind Speed Unit*, *Temperature Unit*, *Dimension Unit* and *Vibration Unit*, as required:

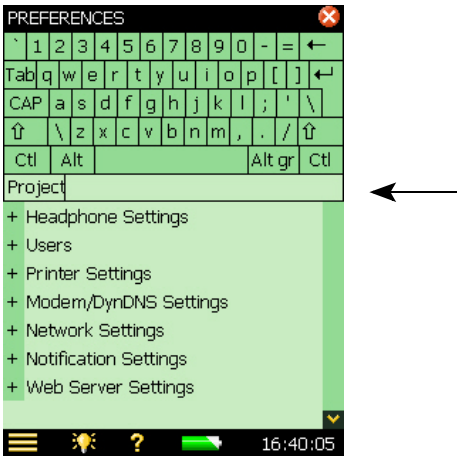
- Use the *SI* setting for measurement units in accordance with the SI standard, for example, measuring Wind Speed in m/s
- Use the *US/UK* setting for imperial measurement units, for example, measuring Wind Speed in mph

When you have made your choices, tap *Regional Settings*, or **-**, to collapse the list.

8.1.4 Storage Settings

Each time you save the results of a measurement, the analyzer suggests a project name and number for the project. The Project Name Prefix can be generated automatically (from the start date of the project as Year, Month, Date in the format YYMMDD, for example, 051112 as 2005, NOVEMBER 12th) or you can specify a *Project Name Prefix* (max. eight characters), using the standard, full character keyboard that pops up when you tap the current name set as the Project Name Prefix (Fig.8.6). (The field where you type in the Project Name Prefix will appear at the top or bottom of the pop-up keyboard, depending on how many settings you have expanded in the list.) The project suffix number will be generated automatically.

Fig. 8.6
Storage Settings screen



8.1.5 Headphone Settings

The *Headphone Settings* allow you to control the output to the headphone socket on the connector panel.

Commentary annotations on measurements can always be heard on the headphones, regardless of the options chosen in *Headphone Settings*.

In addition to the commentary annotations, you can listen to the measured signal for monitoring purposes. Select between *A/B-weighted*, *C-weighted* or *Z-weighted*. (A/B-weighting is determined by setting the parameter in *Setup* > *Frequency Settings* > *Broadband (excl. peak)*).

The measured signal covers approximately 120 dB (from approximately 20 dB to 140 dB with a Type 4189 or Type 4190 microphone of nominal sensitivity). The output of the headphone socket covers approximately 75 dB. Use the *Gain* settings for the measured signal to adjust the output level to suit the listening conditions. If the signal has a very high dynamic range (or the levels are unknown), you can set *Automatic Gain Control* to *On* – this will convert the 120 dB input range to 40 dB output range enabling you to hear signals of any level clearly.

Individual *Gain* settings are provided for the commentary annotations and the measured signal. Tap the gain parameter and use the keypad to enter a new setting. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/decrement the value.

Note 1: A 0 dB gain on the measurement signal means you get a 1 V output for a 1 V input (when the measured signal *Automatic Gain Control* is set to *Off*).

Note 2: While playing back an annotation, you can use the up/down navigation keys to increase/decrease the gain of the annotation.

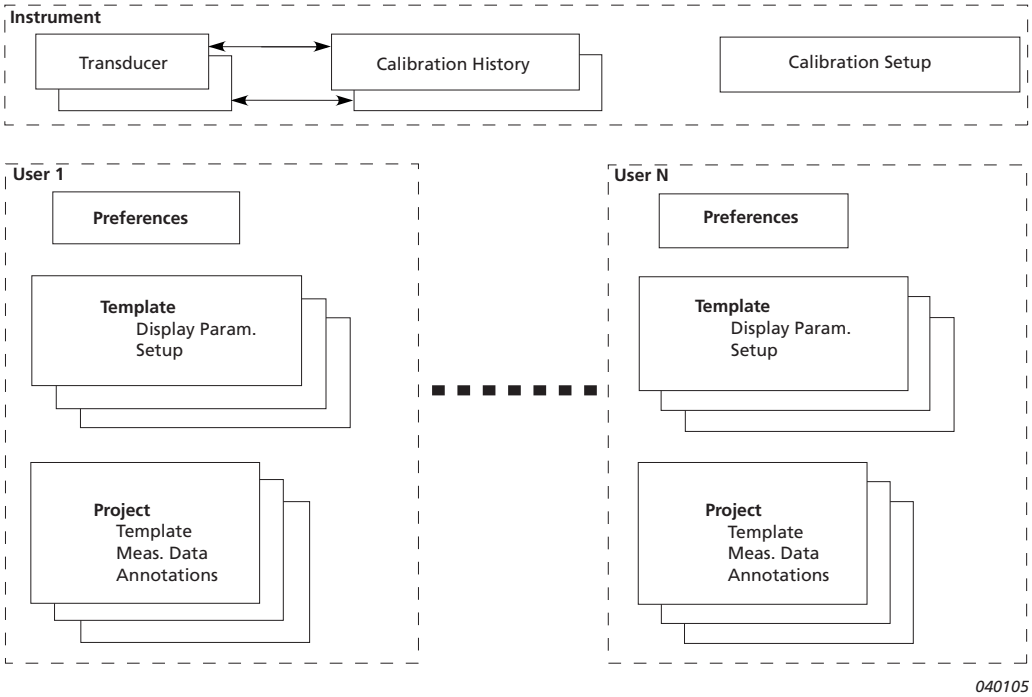
Note 3: If you do not want to listen to the input signal, then set the *Listen to Signal* parameter to *No*, to economise on power.

8.1.6 Multi-user Facility

The analyzer can handle more than one user. Each user can have their own set of preferences, templates and jobs and projects – completely invisible to other users. This can also be very useful in organising large measurement jobs or cases – you can separate the cases completely from each other by handling each case as a separate user.

The transducers, the calibration setup and the calibration histories of the transducers are common to all users, as shown in the overview provided in Fig.8.7.

Fig.8.7 *Overview of Multi-user Facility*



Tap *Users*, or the plus icon +, then select *Yes* in the *Multi User Enabled* drop-down to distinguish between different users.

The analyzer, when delivered, has one default user called ‘2250’ (for Type 2250) or ‘2270’ (for Type 2270).

You require Measurement Partner Suite BZ-5503 (included with the analyzer) to set up new users on the analyzer (see section 7.1).

8.1.7 Printer Settings

You can make screen dumps on a printer connected to the analyzer using a standard USB cable, or on hardware versions 1 – 3, the supplied Adaptor AO-0657. Use the *Printer Settings* to select your preferred printer.

When a printer has been selected under the *Printer Used* parameter, then the **Print Screen** command in the Main Menu list appears. Use this command to print a screen dump of any screen on the analyzer.

The printer must either be a mobile thermal printer (from AM Tech or Seiko) or accept the PCL® printer language:

- *MPS*: Mobile Pro Spectrum – a mobile thermal printer from AM Tech (www.amteq.co.kr)
- *PCL*: printers accepting PCL printer language
- *PCL Inkjet*: suitable for Inkjet printers and supports colour printing
- *PCL Laser*: suitable for laser printers
- *Seiko DPU*: DPU-S245 or DPU-S445 – mobile thermal printers from Seiko Instruments (www.seikoinstruments.com)

PCL is the Printer Control Language developed by Hewlett-Packard (see www.hp.com). For PCL printers, you can use the *Top* and *Left Margin* parameters to position the print on the paper, and use *Width* and *Height* parameters to set the size of the print.

8.2 Modem/DynDNS Settings

You can use the analyzer for monitoring in remote places and control it using Measurement Partner Suite BZ-5503 via a telephone connection – wired or wireless – using suitable modems or via network connections. See the overview of possibilities in Table 7.1. When you connect via a modem, or via a network connection, you will see the contents of the analyzer in the **Instrument Task** as if you had made the connection via USB. You then have the same possibilities for transferring data to the Archives and organising data on the analyzer, as if you were connected via the USB connector.

The analyzer is connected directly to the Internet through a modem. BZ-5503 or an Internet browser will then be able to connect to the analyzer through TCP/IP using the analyzer's (global) IP address. The setup of the modem connected to the analyzer is described in section 8.2.2 – please refer to the BZ-5503 online help for details on how to make a connection.

8.2.1 Connection to the Network using a LAN Modem

Using a 3G modem with LAN interface is a simple and very reliable and powerful way of remotely connecting to the analyzer.

Set up the modem according to its user manual (usually requires connection to a PC) before you connect the modem to your analyzer. When ready, connect the modem to the analyzer using a LAN cable. For hardware versions 1 – 3, you will also need the 10/100 Ethernet CF Card UL-1016. (See "Ordering Information" on page 216.)

The *Modem* parameter should be set to Off.

The Airlink Raven XE, Intelligent 3G Ethernet Gateway from Sierra Wireless (www.sierrawireless.com) has been tested.

Note: The SIM card account should include a data subscription and be usable without a pin code.

8.2.2 Connection to Network using GPRS/EDGE/HSPA Modem

Note 1: Turn off the analyzer when connecting the analyzer to a modem.

Note 2: The SIM card account should include a data subscription and should be usable without a pincode.

To use the modem you need to set up the parameters in *Dialup Networking* (listed below) and set the *Modem* parameter to *GPRS/EDGE/HSPA Dialup*.

Parameters in *Dialup Networking*:

- *APN* (Access Point Name) is an identifier required by the network operator. Examples are Internet, public and www.vodaphone.de
- *Username*, *Password* and possibly *Domain* should be set as required by the network operator

When the *Modem* parameter is set to *GPRS/EDGE/HSPA Dialup*, then a connection is made using the settings in *Dialup Networking*. The *Status* parameter reflects the current status of the network connection – for example, 'Connected' or 'Disconnected'. If the connection fails, then the analyzer will try to reconnect – until it succeeds, or the *Modem* parameter is set to *Disabled*.

If the connection succeeds, then the analyzer will automatically get an IP address, which is readable (but not accessible) in *Network Settings* – for more details see section 8.3.

The IP address is the address on the WAN (Wide Area Network) or Internet. Use this address in BZ-5503 or an Internet browser to connect to the analyzer.

Note: In some cases you might be able to get a static IP address from the network operator, which means that the analyzer will always have the same IP address when connected to the network. However, typically the IP address will be renewed each time the analyzer connects to the network. In order to deal with this, in BZ-5503 or via an Internet browser you need to use DynDNS – see section 8.2.3.

Modems with USB Interface

The Airlink Fastrack Xtend GPRS, EDGE and HSPA modem from Sierra Wireless (www.sierrawireless.com) has been tested

Modems with an USB interface can be connected to the USB Type A socket on hardware version 4.

Modems with RS–232 Serial Interfaces

The following modems have been tested:

- FASTRACK Supreme 10 and 20 GSM/GPRS/EDGE Modem from Wavecom
- Airlink Fastrack Xtend GPRS, EDGE and HSPA from Sierra Wireless (www.sierrawireless.com)

For hardware version 4, modems with an RS−232 serial interface can be connected using a USB to serial converter inserted in the USB Type A socket of the analyzer. The following USB to serial converters have been tested:

- USB to RS−232 Converter UL-0250 (See “Ordering Information” on page 216.)
- ES-U-1001-R10, ES-U-1001-B10 and ES-U-1001-A from EasySync (www.easysync-ltd.com)
- USB to RS232 Standard, USB to RS232 Professional and USB to RS232 Mini STD from U.S. Converters (www.usconverters.com)

For hardware versions 1 – 3, use a compact flash-to-serial converter inserted in the compact flash slot of the analyzer. Serial I/O CF Card – Ruggedized from Socket (www.socket-mobile.com) has been tested.

Compact Flash Modems (for Hardware Versions 1 – 3)

Compact GPRS from Pretec (www.pretec.com) has been tested.

Compact flash modems can be inserted directly in the compact flash socket of the analyzer.

8.2.3 DynDNS

If the analyzer is connected to the Internet through a GPRS/EDGE/HSPA modem or a local network with access to the Internet through a DSL modem/router and you want to connect to the analyzer from a place outside the local network, then you need to know:

- Global IP address of the analyzer, or
- Global IP address of the DSL modem/router (and ensure that correct port forwarding in has been set the router – details in the online help for BZ-5503)

In some cases, the global IP address is static and will never change, so you connect to the analyzer using BZ-5503 or an Internet browser using this IP address.

Normally when you browse to addresses using an Internet browser you do not use the IP address itself, but a hostname for it (for example, you would use the hostname www.google.com instead of ‘74.125.77.99’). This requires a DNS (Domain Name System) provider, which is a kind of Internet phone book that translates hostnames to IP addresses for you.

However, for a GPRS/EDGE/HSPA or even a DSL router, often the global IP address is renewed at each new connection or at certain time intervals (for example, every two weeks). In this case you will have to change the IP address in BZ-5503 or the Internet browser accordingly. To avoid this, a service like DDNS (Dynamic Domain Name System) can be used.

DDNS is a network service that provides the capability for a modem/router/computer system to notify a domain name system provider to change, in real time (ad-hoc), the active DNS configuration of its configured hostnames and IP addresses. This will ensure that the hostname you use will always be updated to reflect the correct IP address.

The analyzer supports DDNS provided by the worldwide DDNS service provider ‘DynDNS.com’.

The analyzer can then be configured to notify DynDNS.com each time the global IP address is set or changed. When BZ-5503 or an Internet browser connects to the analyzer, it then uses a hostname defined by DynDNS.com. From DynDNS.com it then gets the updated IP address.

You need to make an account at DynDNS.com, specifying a user name and a password for the account and a hostname (for example, 'MyBK2250.dyndns.org') identifying your analyzer.

In the analyzer you need to specify the *Hostname*, *Username* and *Password* and set *Active* to *Yes* in *Preferences*, under *Modem/DynDNS* settings. Each time the analyzer detects a change in the IP address it notifies DynDNS.com.

Note: To avoid too much traffic at DynDNS.com, the analyzer ensures that this service does not allow updates of settings more frequently than every 10 minutes. So you may experience up to a 10 minute wait for DynDNS settings to update.

8.3 Network Settings

The analyzer can be connected to a LAN (Local Area Network) through an Ethernet interface or to WLAN (Wireless Local Area Network) using equipment conforming to the IEEE 802.11a/b/g standard. This connection can be used to synchronise measurement and setup data with a host PC using BZ-5503.

The analyzer supports TCP/IP (Transmission Control Protocol/Internet Protocol) on the LAN and WLAN.

This requires the analyzer to have a unique address on the network. This address is called an IP address and consists of four sets of 3-digit numbers, for example, 010.116.121.016.

The IP address can be obtained in different ways:

- *Automatically*
- *Using DHCP*

  A DHCP (Dynamic Host Configuration Protocol) Server on the network assigns automatically an IP address to the analyzer when connected to the network. This is the most common way of setting up IP addresses
- *Using Link-local*

  If no address is automatically assigned by the DHCP Server, then after a few seconds the analyzer will use an address from the Link-local address range 169.254.x.x

  This will most likely be the case when connecting the analyzer directly to a PC using an Ethernet crossover cable
- *Manually*

  You setup the IP address manually

  This will typically be the case in a private network without a DHCP Server

8.3.1 Connecting to the Analyzer

Wired LAN Connection

- Use a “straight-through” (standard) Ethernet cable with RJ45 connectors at both ends to connect the analyzer to the network (via a hub, switch or router)
- Use a “crossover” Ethernet cable with RJ45 connectors at both ends to connect the analyzer directly to a PC

Hardware version 4 has an Auto-MDIX facility, allowing you to use either a straight-through or crossover cable to connect to a network or PC.

With hardware versions 1 – 3, only Type 2270 has a built-in LAN socket on the connector panel (see section 2.3).

WLAN Connection

Types 2250 and 2270 provide a wireless LAN option using a WLAN card.

Types 2250 and 2270 with hardware version 4 accept the following SD WLAN card:

- P322 802.11abg SD WLAN from Socket Mobile (www.socketmobile.com) – Brüel & Kjær order number UL-1025

Types 2250 and 2270 with hardware versions 1 – 3 accept the following compact flash LAN and WLAN cards:

- 10/100 Ethernet Ruggedized CF Card from Socket Mobile (www.socketmobile.com) – Brüel & Kjær order number UL-1016
- Go Wi-Fi!® P500 CF WLAN, rev. B and rev. C from Socket Mobile – Brüel & Kjær order number UL-1019

8.3.2 Parameters in Network Settings

Location

Use the *Location* parameter to specify a text up to 20-character long, identifying the analyzer or location of the analyzer. The *Location* will be displayed on the PC as well as the serial number of the analyzer when browsing for analyzers in BZ-5503 and when connected using the online display

Note: The *Location* parameter is useful for both USB and LAN connections

Network Connection

- Hardware versions 1 – 3:

  Type 2250:

  – *None*: (default)

  – *CF Socket*: Select this to use an Ethernet CF Card in the Compact Flash socket

Type 2270:

- *LAN Socket*: (default) Select this to connect via a LAN cable. This is disabled if an Ethernet CF card is inserted in the Compact Flash socket
- *CF Socket*: Select this to use an Ethernet CF Card in the Compact Flash socket

• Hardware version 4 (G4):

For all analyzer types, the default is *LAN Socket*

Set IP Address

Automatically: This will obtain an IP address from a DHCP server – if no server available, then a Link-local address will be set

Manually: You have to set the *IP Address*, *Subnet Mask*, *Default Gateway*, *Preferred DNS* and *Alternate DNS* (see below)

IP Address

The IP address of the analyzer

Selectable if Set IP Address = *Manually*

Subnet Mask

The *Subnet Mask* combined with the *IP Address* identifies the network segment the analyzer is on

Selectable if Set IP Address = *Manually*

Default Gateway

Address to a gateway for routing to another network

Selectable if Set IP Address = *Manually*

Preferred DNS

The IP address of the primary DNS server

Alternate DNS

The IP address of the secondary DNS server

MAC Address

The MAC address of the network adaptor (LAN or WLAN) in use. MAC (Media Access Control) address is a unique identifier assigned to the network adaptor. This field is for information only

Status

The status of the network connection, either *Operational* or *Non-operational*:

- *Operational*: the network adaptor can be used for a connection
- *Non-operational*: the network adaptor cannot be used

Parameters for Wireless LAN Only

Name

Name (SSID) of the network you want to connect to. Update the name either by:

- entering a name directly, or
- tapping on *Available Network*s and selecting a name from the list

Available Networks

Tap the line to get a list of available networks. Tap a name in the list to connect to this network. The name is inserted in the *Name* line above this line. Each network name is preceded with *Signal Strength* information, ranging from *Excellent* (displayed as '• • • • •') down to *No Signal* (displayed as no dots at all)

Security

Select the *Security* as required by the network: *Open*, *Shared*, *WPA PSK* or *WPA2 PSK*. Open and Shared are for WEP (Wired Equivalent Privacy) Infrastructure mode. WPA PSK is for WPA (Wi-Fi Protected Access) with Pre-shared Key (also called Personal mode). WPA2 is an enhanced version of WPA

Encryption

Select the *Encryption* as required by the network: *None*, *WEP Enabled*, *AES Enabled* or *TKIP Enabled*. None is for Open security. WEP Enabled is for Open and Shared security. AES and TKIP Enabled are for WPA PSK and WPA2 PSK security

Encryption Key

Insert the *Encryption Key* required by the network. The key will be displayed until you press **Enter**, then it will be replaced by ' *** '

8.4 Notifications

The analyzer can send you a daily status or notify you if noise level exceeds a set threshold level, if disk space is getting low or external power has disappeared, etc. This is done via SMS (text message) or e-mail, as described in this section. The SMS/e-mail notification contains a short status report for the analyzer. This facility is especially useful if the analyzer is left for unattended monitoring.

8.4.1 Alarm Settings

If one or more of the following alarms occur, then a notification will be issued as either an SMS or an e-mail, depending on your equipment and settings. If the notification fails (for example, the connection has been lost), then the analyzer will retry to send the notification once more after five minutes.

Table 8.1 *Alarm Settings*

Alarm Type	Condition	Comment
Power On	When analyzer is switched on or reboots	Indicates start from a timer, or a power failure, or unexpected behaviour
Measurement State	When a measurement starts or stops	Indicates measurement finished – or unexpected behaviour
CIC	When Charge Injection Calibration fails	Indicates possible measurement problem
Internal Battery	When Internal Battery is entering a specified state: High, Low or Critical.	Indicates internal battery getting low. Internal Battery will be in one of the states: Full, High, Low, Critical, Charging or Unknown. You can set alarm to *High, Low* or *Critical* in *Preferences* > *Notification Settings* > *Alarm Settings* > *Internal Battery.* **Note:** The internal battery will typically be in one of the states *Full* or *Charging* if externally powered. Entering one of the set states might then indicate a power failure
Trigger Input Voltage	When voltage at Trigger Input drops to or below a specified level	Indicates no external power, or external battery getting low. Set *Setup* > *Input* > *Trigger Type* to *Voltage for Monitoring*. Set the voltage limit in *Preferences* > *Notification Settings* > *Alarm Settings* > *Trigger Input Voltage*. Connect the external battery or external power to this input (in addition to the External Power Socket) to get an alarm if the voltage drops to or below the specified level
Disk Space	When remaining disk space drops to or below a specified percentage of the total disk space	Indicates disk space getting low – needs to be swapped with an empty disk. Set the percentage in *Preferences* > *Notification Settings* > *Alarm Settings* > *Disk Space*
Level Trigger	When level trigger conditions are fulfilled	Indicates sound level exceeds trigger level specified in Logging or Enh. Logging template
Report Level	When L_{Aeq} of the latest Report Period exceeds Report Threshold Level	Indicates that the sound level L_{Aeq} for the latest Report Period exceeds Report Threshold Level. **Note 1:** If you specify a very low Report Threshold Level you will receive a notification at the end of each Report Period **Note 2:** Only available when running the Enhanced Logging template **Note 3:** For 2-channel Enh. Logging the Report Threshold Level is used for Ch.1 and Report Threshold Level 2 is used for Ch.2.

Table 8.2 *Content of Notification*

Information Type	Content
Reason for notification	'*Test*', '*Alarm*' or '*Status*' followed by a short description
Time of notification	*Date* and *Time*
Instrument ID	*Serial No*. and *Location*
Status of current Disk	*Free memory* / *Total memory*
Status of Internal Battery	*Full*, *High*, *Low*, *Critical*, *Charging* or *Unknown*
Trigger Input Voltage (if available)	*The voltage*
Measurement Status (if available)	*Running*, *Paused* or *Stopped*
No. of Signal Recordings (if available)	The number of signal recordings made since start of measurement
Latest CIC Result (if available)	*Passed*, *Background noise too high*, *Ratio outside tolerances*, *Ratio deviates from Ref.*, *Undefined Ref.*, or *Undefined. For 2-channel measurements: One CIC result per channel*
Current value of LAF (if available)	The value*. For 2-channel measurements: One CIC result per channel*
Report Threshold Level	The value
Report Level LAeq	The value

Note: Some of the information listed above may not be available, depending on the conditions when the notification was sent, for example, no measurement values will be available immediately after a power on.

8.4.2 Text/SMS Notifications

Notifications via SMS (text message) can be used if you have connected a GSM/GPRS/EDGE/HSPA modem to the analyzer (see section 8.2.2) and set *Modem* to *Disabled* (a text message cannot be sent if the modem is set to *GPRS/EDGE/HSPA Dialup*).

In addition to sending notifications initiated by alarms, you can send an 'Info' text to the analyzer and ask for an SMS notification, after which you will get a notification within 30 seconds.

You need to setup a *Phone Number* in *Preferences* > *Notifications* > *SMS* and set *Active* to *Yes* for the SMS. You can also add a *Name* for the number for easier identification.

You can setup two individual SMS phone numbers for sending the SMS notification to two recipients.

Set *Notification* to *SMS* and a notification will be sent by SMS to the active phone numbers, when any of the alarm conditions are met, or if the analyzer receives an 'Info' SMS.

You can test the system by tapping on the **Main Menu** icon and selecting "*Send Notification* via SMS".

Note 1: Two to three text messages will be used to send the complete notification – depending on the content and language settings.

Note 2: Text messages cannot be sent or received while the analyzer is connected to BZ-5503 or displayed online.

8.4.3 E-mail Notifications

E-mail notifications can be used if the analyzer is connected to a network with access to a mail server. This can typically be done if the analyzer is connected through LAN or by a GPRS/EDGE/HSPA modem (see section 8.2.2 and section 8.3).

Go to *Preferences* > *Notifications* > *E-mail* and setup details for the e-mail account under the *To* parameter. The details consist of the *SMTP* server name, the *SMTP Port* used, whether *SSL/TLS* is required or not, the *Account*, the *Username* and *Password* for the account – please consult section D.10 (Appendix D) and your e-mail provider for more details.

Set *Notification* to *E-mail* and a notification will be sent by e-mail when any of the alarm conditions are met.

You can test the system by tapping on the **Main Menu** icon and selecting *Send Notification via E-mail*.

Example of e-mail:

Subject: E-mail from 2479719 Abbey Road Test: Manual e-mail

Test: Manual e-mail

29-04-2009 12:51:16

Instrument 2479719 Abbey Road

SD-Card 383 MB / 483 MB

Internal Battery Charging

Trigger Input Voltage 13.5V

Measurement Status Running

No. of Signal Recordings 13

CIC Result Passed

LAF 45.8dB

8.5 Web Server

To connect to the analyzer using an Internet browser, the following conditions must be fulfilled:

- The analyzer must be connected to a network as described in section 8.2.2, section 8.2.3 and section 8.3
- The Internet browser must support JavaScript®

The web page of the analyzer has been tested on the following Internet browsers:

- Microsoft® Internet Explorer®, from version 7
- Mozilla® Firefox®, from version 3
- Google Chrome™, from version 2
- Apple® Safari®, from version 4

You may also be able to connect to the analyzer using Internet browsers on smart phones such as an iPhone®.

8.5.1 Password Protection

Connection to the analyzer is password protected. There are two levels of protection:

- Guest – for viewing only
- Administrator – for viewing and controlling the analyzer

Username and Password

Under *Preferences* you set the *Username* and *Password* individually for the *Guest* and for *Administrator* accounts.

You need to specify *Username* and *Password* for the Administrator, however, you can specify whether a guest requires a login or not.

8.6 Connecting to Weather Stations and GPS Receivers

8.6.1 Weather Stations

The analyzer can be connected to the following weather stations:

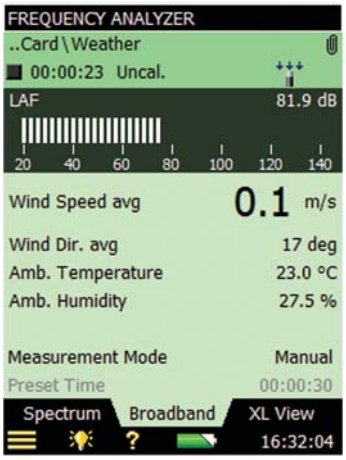
- Weather Station MM-0316 – for measurement of wind speed and wind direction
- Weather Station MM-0256 – for measurement of wind speed, wind direction, ambient temperature, ambient pressure, relative humidity and liquid precipitation

Please refer to the user manual for Noise Monitoring Terminal Type 3639-A, B and C (BE 1818) for details on how to mount and connect the weather station using Utility Unit ZH-0698.

When you have connected the Weather Station, you can verify the connection by displaying the instantaneous updated parameters *Wind Dir.* and *Wind Speed* from the *Weather* group.

Data from the weather station is automatically obtained during the measurement and saved on data – see measurement parameters in Appendix B. The measured data can be displayed as parameters from the *Weather* group.

Fig. 8.8
Data from weather station obtained during a measurement and saved on data



8.6.2 GPS Receivers

The analyzer can be connected to the following GPS receivers:

- GPS Receiver ZZ-0249 – for measurement of latitude, longitude, altitude and position error

  Please refer to the user manual for Noise Monitoring Terminal Type 3639-A, B and C (BE 1818) for details on how to mount and connect the GPS receiver using Utility Unit ZH-0689.
- ND-100S GPS USB Dongle from Globalsat (www.globalsat.com.tw) – for measurement of latitude, longitude and altitude
- BU-353 Cable GPS with USB Interface from Globalsat – for measurement of latitude, longitude and altitude

The GPS receivers with USB interface can be connected directly to the USB port on analyzers with hardware version 4. On hardware versions 1 – 3, the GPS receivers can be connected using USB Adaptor AO-0657.

The first time you connect the GPS receiver to the analyzer (or if it has been several days since you last connected them), be sure to be in an open area with a clear view to the sky (such as a park or empty field). Wait for GPS initialization to complete. This may take a few minutes depending on factors such as the distance from the previous coordinates, GPS signal strength and surrounding terrain (tall trees and buildings can block the satellite signals).

Once the Latitude and Longitude (from the *Special* parameter group) display data, a fix has been initialized (the LED on the GlobalSat GPS will also start to flash).

In some cases initialization can take up to several minutes depending on the conditions mentioned above before complete GPS data are displayed on the screen. The GPS may get a faster fix if connected through a small USB cable (delivered together with the GPS).

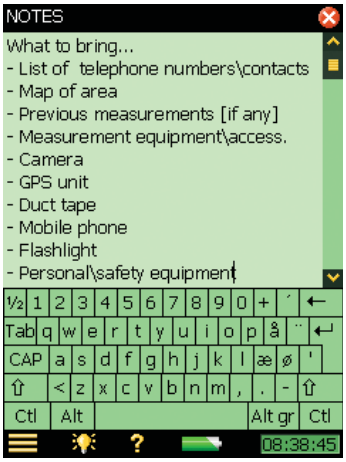
If a GPS receiver is connected when data are saved in a project, a GPS note is automatically created as an annotation with the GPS information.

See more details on GPS notes in section 3.5.

8.7 Preparing your Measurements

You can prepare your measurements in advance by making job folders, setting up the correct measurement parameters in the templates, defining settings for metadata and by making checklists (see example in Fig. 8.8) either as memos containing addresses and phone numbers of relevant people, or notes that have been partly filled-in beforehand, where you just have to fill in the final information on location. The notes can be attached to jobs as annotations, and can be copied onto projects, when necessary.

Fig. 8.9
Example notes screen



When you have finished typing in your note, tap the icon to accept the changes and save it as a text annotation. See section 3.5 for more details on annotations.

8.7.1 Metadata

For easy and convenient use of metadata, it is an advantage to define the settings for the metadata entered and displayed on the Annotations screen (see section 3.5) in advance.

Define settings for each of the 30 metadata. Tap the **Edit** icon in front of the metadata you want to edit (Fig. 8.10) to define:

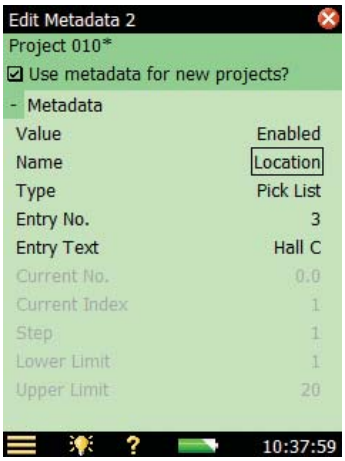
- *Metadata*:
  - *Enabled* (visible and editable on the Annotations screen) or
  - *Disabled* (invisible on the *Enabled* (visible and editable on the Annotations screen)
- *Name*: Insert a name preceding the metadata value when displayed on the Annotations screen
- *Type*: Select a type suitable for your metadata. Select between:
  - *Text*: The metadata is the text you enter or edit using the alphanumeric keyboard
  - *Pick List*: The metadata are selected from a list of up to 30 user-defined texts
  - *Number*: The metadata number is entered using the numeric keyboard
  - *Index*: The metadata number is automatically incremented after creating the project
  - *Not defined*: The metadata are removed from the project. This will be the initial state of metadata for old projects without metadata.
- *Entry No.* (for type = *Pick List*):
  - The entry number for the text to be defined in the pick list. Select the required number and enter text in the *Entry Text* field
- *Entry Text*:
  - For Type = *Text*: The text
  - For Type = *Pick List*: The text for the selected *Entry No.*
- *Current No.*: For Type = *Number*: The number
- *Current Index*: For Type = *Index*: The index
- *Step* (for Type = *Index*):
  - The *Current Index* is incremented with *Step* after creation of a project
  - The index wraps around when exceeding *Upper Limit* or getting below *Lower Limit*

  Note: *Step* can be negative
- *Upper Limit*: For Type = *Index*: The upper limit of the index
- *Lower Limit*: For Type = *Index*: The lower limit of the index

At the top of the screen you can set a checkmark to use the settings for this metadata on new projects when closing the display.

The checkmark is disabled for changes to the definition of the metadata currently in use because this will always be used for new projects, however, when you are editing or looking at metadata from a previously saved project you can decide whether to use the settings on new projects too or keep the changes to the project only.

Fig.8.10
Edit metadata



8.7.2 Timers and Automatic Measurements

Automatic control of the analyzer is available via one or more of the analyzer's timers (up to ten).

The purpose of a timer is to initiate measurements in the absence of an operator. Basically, a timer will:

- Switch on the analyzer at a preset time
- Load a preselected template
- Start a measurement as specified in the template
- Stop the measurement after a preset time defined by the Timer Setup
- Save the measurement
- Switch the analyzer off
- Repeat the above a preset number of times at preset intervals

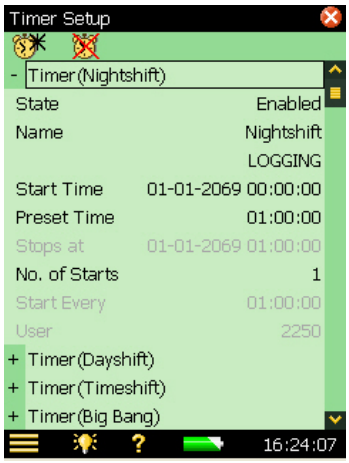
For a timer to work, the analyzer must be in the 'switched off' state.

A timer will never interrupt the analyzer if it is already in use manually. If a switch-on time is set during the time the analyzer is in use, the timer opportunity is lost.

You can control the analyzer during a timer-initiated measurement as long as this does not affect the measurements. If you try to change any parameters affecting the measurement you will be warned of this. If you persist, the analyzer will revert to manual control and timer control cannot be resumed.

The **Timer Setup** lists the timers that have been defined previously on the analyzer (that is, added by you or previous users).

Fig.8.11
Example Timer Setup



In the topmost line you can add other timers by tapping on the **Add New Timer** icon. You can delete a timer from the list by tapping on the **Delete Timer** icon. Only timers created by the current user can be deleted. To delete a timer defined by another user, you have to logon as the other user and then delete the timer.

For each timer you can specify:

- *State:* Enable or disable the timer
- *Name:* Name the timer
- *Template:* Select the template you want to use for the measurement.
  Note: Reverberation Time templates are not available for timer control
- *Start Time:* Set the start time – at least 3 minutes ahead of current time
- *Preset Time:* Set the preset time for the measurement – regardless of the settings in the template used by the timer
- *Stop Time:* The time when the measurement stops – for information only
- *No. of Starts:* Set to the total number of times you want to start the measurement
- *Start Every:* The time interval between the start of each successive measurement. This interval must be greater than *Preset Time* + 3 minutes
- *User:* The user who specified the timer. Cannot be changed

Note: When using timers for automatic measurements, ensure the meter is connected to a stable power supply. It is advised to set the *Ext. Power* switch to *Charge battery only* – see section 8.1.2.

Chapter 9

Updating and Upgrading Applications, Maintenance, Calibration and Troubleshooting

9.1 How to Install New Applications

Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223, Logging Software BZ-7224, Enhanced Logging Software BZ-7225, Signal Recording Option BZ-7226, Reverberation Time Software BZ-7227, Building Acoustics Software BZ-7228, FFT Software BZ-7230, Tone Assessment Option BZ-7231, Noise Monitoring Software BZ-7232 and Low Frequency Option BZ-7234 are pre-installed on Types 2250 and 2270. In addition, 2-channel Option BZ-7229 (and the 2-channel modules for Sound Level Meter, Frequency Analysis, Logging, Enhanced Logging and Building Acoustics software) and Sound Intensity Software BZ-7233 are pre-installed on Type 2270. However, a valid license is required to run the software. If you have purchased the analyzer together with the software application(s), then the relevant license(s) will come pre-installed on the analyzer.

If you purchase a separate software application for your analyzer, then you have to install the license onto the analyzer. This is done using Measurement Partner Suite BZ-5503, please consult the on-line help included with the BZ-5503 software for instructions on how to install a license.

Tap ?, on the analyzer's screen, then **About** to get a list of installed software and licenses.

9.2 How to Update/Upgrade Applications and Install New Languages

Brüel & Kjær recommends that you always use the most current software available. New versions of the analyzer software are available for download via the Brüel & Kjær website (www.bksv.com), which you may want to install on your analyzer. To do this, use Measurement Partner Suite BZ-5503, or connect the analyzer directly to the Internet to download. Some software versions will be free updates, and some will be upgrades requiring that a new license is purchased.

9.2.1 Update/Upgrade using BZ-5503

BZ-5503 can be used for updating or upgrading new software applications on your analyzer. It can even downgrade to specific software versions if required by type approval authorities. Using BZ-5503, you can also install licenses for the specific applications; and, if you have hardware version 1 – 3, install your preferred language (with G4 hardware, all languages are pre-installed in the analyzer). Installation requires a USB connection between BZ-5503 and the analyzer.

The BZ-5503 software will clearly indicate if the new software version is an update (free of charge) or an upgrade (license fee). Please consult the on-line help included with the BZ-5503 software for instructions on how to install upgrades/updates of the software, together with your preferred language.

Tap ?, on the analyzer's screen, then **About** to get a list of installed software and licenses.

9.2.2 Update through the Internet

The analyzer can update software by itself, if it is connected to the Internet – see section 7.1.

This method is particularly useful if the analyzer is used for long-term monitoring, and you do not want to go to the measurement site for servicing (that is, you want to disturb the measurement as little as possible).

Note: The method is used for updating the software with the latest version available from the Brüel & Kjær website. The languages already installed will be updated at the same time. If you have hardware versions 1 – 3, you cannot install new languages or licenses – to do this, you must use BZ-5503.

The update procedure is as follows:

1) Tap ?, on the analyzer's screen, then **About** to get a list of installed software and licenses. Scroll down to the bottom of the screen and tap the *Check for updates on the web…*> link, the Software Update screen appears – see Fig. 9.1and Fig. 9.2.

   Note: This can be done remotely if you connect to the online display using either BZ-5503 or an Internet browser.

2) Click on the **Check for Updates** button to check for the latest updates. This will connect to the Brüel & Kjær update server. If a new software version is available, the build version will be displayed and you can decline or start the update (you will be warned, if the new version requires a new license). If the versions that are available are not later than those already installed you will be told so and the update will be terminated.

3) If you choose to update the analyzer, the software will start downloading to the SD or CF card (hardware versions 1 – 3) already inserted in the analyzer. You need at least 200 MB of free space on the memory card. Depending on the speed and quality of the Internet connection, this can take from a few minutes to several hours. If the connection is lost, then the download will automatically continue when connection is established again.

Note: The analyzer can continue measuring during the download period.

4) When download is complete, the measurement is paused and normal use of the analyzer is prevented. Connections to the analyzer are terminated and the upgrade of the analyzer will start. This will take 10-15 minutes and the analyzer will reboot when finished. Any unsaved logging data will be saved and the analyzer is ready to use again.

5) Connect to the analyzer again and verify the new software version by tapping ?, on the analyzer's screen, then **About**.

To continue the measurement, press the **Start** pushbutton.

Note: If you have set up your analyzer for e-mail notifications (see section 8.4), then you will get an e-mail in step 4) when the analyzer is paused, and you will get a new e-mail in step 5), when the analyzer has rebooted and is ready for connection again.

Fig. 9.1
About *screen – showing the 'Check for updates on the Web link'*

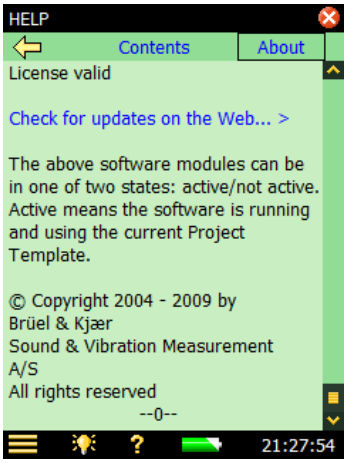
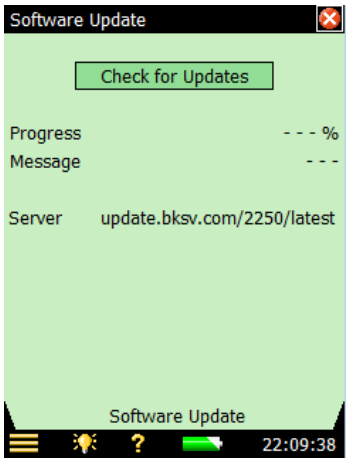

HELP
Contents
About
License valid
Check for updates on the Web... >
The above software modules can be in one of two states: active/not active. Active means the software is running and using the current Project Template.
© Copyright 2004 - 2009 by Brüel & Kjær Sound & Vibration Measurement A/S
All rights reserved
--0--
21:27:54

Fig. 9.2
Software update screen – showing the 'Check for updates button'



9.2.3 Downgrade to an Earlier Version

It is possible to downgrade to an earlier version of the software:

1) Change the "*latest*" part of the server address (see Fig.9.2) to the requested software package, for example, "*SW22*"
2) Press **Check for updates**.
3) Follow the procedure described in section 9.2.1 or section 9.2.2.

Note: Only software packages equal to or above SW24 can downgrade to another package. Software packages down to SW21 are available for update through Internet.

9.3 How to Move a License

If you have more than one analyzer, you may want to share application software between the analyzers. You can do this by moving the license from one analyzer to another by using Measurement Partner Suite BZ-5503, together with the License Mover VP-0647.

If you lend out your analyzer, you may want to temporarily 'un-install' applications not needed. This can be achieved by moving the license of the application to License Mover VP-0647. When needed again, you move the license back to your analyzer.

Please consult the on-line help included with the BZ-5503 software for instructions on how to move a license.

9.4 Troubleshooting

9.4.1 Measurements

If your measurement seems to be wrong, then:

- Check the cabling, if any
- Check that the microphone, including preamplifier, is correctly mounted in the top socket (or correctly connected to the extension cable)
- Check that the *Input* parameter is set to *Top Socket*/*Rear Socket* in agreement with how you are going to use the input. This is found by tapping the **Main Menu** icon , then *Setup***,** followed by *Input*
- Check that the transducer you have mounted on your analyzer is selected as the *Transducer* parameter, this is also found on the Setup screen
- Check whether the parameters for the selected transducer (*Transducer*) are set correctly, especially the *Microphone Type* and *Polarization Voltage* parameters. These are found by tapping the **Main Menu** icon , then *Transducers*
- Check that the *Sound Field* and *Windscreen Correction* parameters have been set correctly These are found by tapping the **Main Menu** icon , then *Setup***,** followed by *Input*
- Check if the calibration is OK (make a new calibration using an external calibrator)

9.4.2 SD/CF Cards and USB Sticks

The Logging, Enhanced Logging and Signal Recording software requires that measurements are saved on memory cards – SD or (with hardware versions 1 – 3) CF. A USB memory stick can be used from hardware version 4.

Device Format and Speed

In order to ensure reliable operation with the memory device, the format of the file system and the speed of the device are tested. Upon insertion, the analyzer verifies the format of the memory device's file system. If the file system is not optimal for usage with the analyzer, then you are prompted to format it. You will be guided through the process.

When the format of the file system has been accepted, then the speed of the device is tested. The test writes data to the device and measures the writing speed. The test takes less than a minute. If the speed test is successful, then you can proceed using the device, otherwise you should use another memory device or try reformatting the device (if not done already).

Problems with Storing or Recalling Data

If you experience problems in storing or recalling data on the memory device, you can check and repair the integrity of the file system on the device or even re-format it, by doing the following:

1) Insert the memory device in the correct slot of the connector panel of the analyzer.
2) You will be notified that a memory device has been inserted – select *Yes* to change the default measurement path toit.
3) Tap the **Main Menu** icon and then *Explorer.*
4) Tap the icon to go up folder levels until you have reached the topmost level with a list of the available memory devices.
5) Tap the name of the device (not the icon) to get a list of available commands.
6) Select *Check and Repair* to start the procedure. If any errors are found in the file system, they are fixed. When finished, you will be informed whether the memory device was OK or that errors have been fixed.

   Note: The checking procedure can take several minutes, depending on the size of the device.

Formatting a memory device:

7) Select **Format** to start the formatting procedure.

⚠ **WARNING:** All data on the device will be erased during the formatting process.

⚠ **WARNING:** Do not remove the device or switch off the analyzer during the procedure – this might damage the file system and data and make the device unusable.

Note 1: The formatting procedure can take several minutes – depending on the size of the device.

Note 2: The read/write performance of SD and CF memory cards and USB sticks varies a lot. The performance depends on the manufacturer of the memory device, the type of device, the

size of the device, how much it has been used, how fragmented the memory is, and even the day of production of the device. Two 'identical' memory devices can have a different performance because the manufacturer has changed the internal technology without notice.

In general, as a rule of thumb, you should select devices aimed for the industrial or professional photographer market.

The cards delivered by Brüel & Kjær have all been tested for their read/write performance in the analyzer and can be used for the applications available in the analyzer. If you need more (or other) types of memory devices, please consult your local Brüel & Kjær representative.

Remember to regularly re-format the device (especially before a long unattended measurement) – this will ensure the best performance of the device.

8) Select **Test Speed**, if you want to check the device's file speed.

9.4.3 Battery Pack and Recalibration of Battery Charge Indicator

The software keeps the capacity of the battery pack updated. Over time the total capacity of the battery pack decreases. If you find that the 'Time Remaining' estimate (tap the **Battery** icon to get this information) does not match the real time remaining (for example, the analyzer switches off automatically because of lack of power while the Time Remaining estimate indicates at least ½ hour), then you should manually re-calibrate the capacity of the battery pack. This is done using the following method:

- Drain all the power from the battery:
  - Switch the analyzer on
  - Disconnect external power
  - Disconnect the analyzer from the PC
  - On the Preferences screen, under *Power Settings*, set *Standby After* to *Never*
  - You may want to set *Backlight On* to *Always* (in the same menu) and select the maximum level of display backlight in order to drain the battery faster (use the **Backlight** icon at the bottom of the screen)
  - Leave the analyzer until the battery voltage becomes so low that the analyzer switches itself off
- Charge the battery fully (at least 10 hours):
  - Connect the Mains Power Supply ZG-0426 to the analyzer
  - Switch the analyzer on (and leave it on) and remember to reset the *Standby After* and *Backlight On* to your preferred settings
  - Tap the **Battery** icon and a pop-up appears, giving details of the battery condition. This will indicate 'Calibrating Battery' initially. Let the battery charge until the battery charge indicator just below the power socket starts flashing green (hardware versions 1–3) or changes from red to green (hardware version 4) and the 'Calibrating Battery' indication disappears from the pop-up window

9.4.4 Touch Screen

If tapping with the stylus on the screen seems to be getting more inaccurate, you can adjust the touch sensitive screen, as follows:

- In the Preferences screen, under *Display Settings* activate the link *Adjust Touch Screen*. This displays a full screen with guidance on how to tap a cross five times at different places on the screen. The adjustment procedure ends with saving the values or canceling the adjustment

9.4.5 Reset Options

Reset Button

⚠ **WARNING:** Unsaved data or setups will be lost when you reset the analyzer.

If your analyzer stops responding to pushbutton presses, or stylus taps, reset and reboot the analyzer by pressing the **Reset** button (located on the connector panel – see section 2.2) with the point of the stylus.

If you still experience problems, try resetting your analyzer as described below.

Analyzer Reset

1) Reset the analyzer to a default/factory installed state:
   – For hardware versions 1 – 3, you will reset the analyzer to a default state, where the user is set to *2250* (for Type 2250) and *2270* (for Type 2270) and the project template is set to **Sound Level Meter**. The existing **Sound Level Meter** project template will be overwritten, as will the preferences for user 2250 or 2270. To reset the analyzer to the default state:
     a) Press and hold the **Power-on** pushbutton for at least five seconds (powers off).
     b) Press and hold down the **Commentary** and **Save** pushbuttons while switching on the analyzer. The display in Fig.9.3 will be shown.

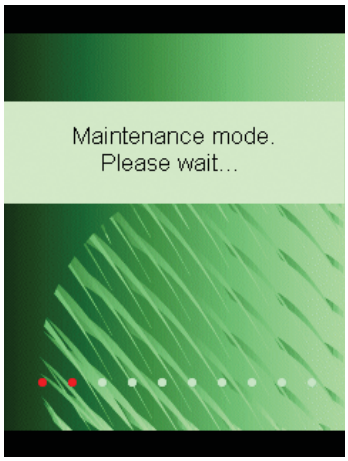


Fig. 9.3
Maintenance Mode –initial screen for hardware versions 1 – 3

Within a few seconds the display in Fig. 9.4 will be shown.

Fig. 9.4
Update 2250 software screen for hardware versions 1 – 3

c) Cancel the update by pressing any other pushbutton than the **Accept** pushbutton ✓.

Fig. 9.5
Reset to default settings screen for hardware versions 1 – 3

d) Press the **Accept** pushbutton ✓ to reset to default settings.

– With hardware version 4 (G4), the analyzer contains two sets of the firmware/software package and settings. The one originally delivered with the analyzer and one installed afterwards. To restore the factory firmware/software package and settings:

a) Press and hold the **Power-on** pushbutton for at least five seconds (powers off).

b) Press and hold down the **Commentary** and **Save** pushbuttons while switching on the analyzer. The display in Fig. 9.6 will be shown.

Fig. 9.6
Restore factory firmware and settings on hardware version 4

c) Press the **Accept** pushbutton ✓ to restore factory firmware and settings.

If the analyzer now functions normally, you should install the software package of your preference as described in section 9.2. Brüel & Kjær recommends that you always use the latest available.

2) (for all hardware versions) If the analyzer now functions normally, define your preferred settings in the Preferences screen, adjust the touch screen again and make necessary changes to Setup (all accessed via the **Main Menu** ☰).

If you experience problems selecting another template or you login as another user, then note which step causes the problem. You might need to delete/reconfigure the templates or users.

To delete/reconfigure templates or users, use Measurement Partner Suite BZ-5503 with the analyzer connected to the PC via Micro USB Cable AO-1494 (G4 hardware) or Mini USB Cable AO-1476, or a modem/LAN connection. Please consult the on-line help included with the BZ-5503 software for instructions on how to configure the analyzer.

Re-installing Software (Hardware Versions 1 –3)

If the analyzer still does not work normally after performing the 'Analyzer Reset' procedure, then the software might need to be re-installed. This can be done in two ways:

1) If the connection to Measurement Partner Suite BZ-5503 works with the analyzer connected to the PC using a USB cable, then the software can be re-installed and re-configured through the USB cable. Please consult the on-line help included with the BZ-5503 software for instructions on how to re-install software on the analyzer.

2) If the USB connection to the PC does not work, then you need a Compact Flash card (size at least 64 Mbytes) and a Compact Flash card reader for the PC. You can then use Measurement Partner Suite BZ-5503 to update the Compact Flash card with the necessary files. Please consult the on-line help included with the BZ-5503 software for instructions on how to update a Compact Flash card with installation files for the analyzer.

   Power off the analyzer and insert the compact flash card in the CF slot on the analyzer. Then press and hold down the **Commentary** and **Save** pushbuttons while switching on the

analyzer. The Maintenance Mode initial screen will be displayed, and then within a few seconds the screen shown in Fig.9.4 will appear.

Press the **Accept** pushbutton ✓ to update the software. This will take approximately 5 minutes.

⚠ **WARNING:** Do not remove the CF-card while updating the analyzer software!

When the analyzer software has been updated, you will get the option of resetting to the default settings.

If the problem still persists, then you should contact your local Brüel & Kjær representative.

9.5 Care, Cleaning and Storage

The analyzer is a delicate precision instrument. When handling, storing or cleaning your analyzer, please take the following precautions.

9.5.1 Handling the Analyzer

- Do not try to remove the microphone grid as you can easily damage the microphone in this way
- Do not attempt to open the analyzer. There are no user-serviceable parts inside. If you think your analyzer requires service, please contact your Brüel & Kjær representative
- Do not allow the analyzer to get wet
- Protect the analyzer from impact. Do not drop it. Transport it in the supplied carrying pouch

9.5.2 Cleaning the Analyzer

If the analyzer casing becomes dirty, then wipe it with a lightly dampened cloth. Do not use abrasive cleansers or solvents. Do not allow moisture to enter the microphone, connectors or casing.

9.5.3 Storing the Analyzer

- Keep the analyzer in a dry place, preferably within its carrying pouch
- For long-term storage, remove the battery pack
- Do not exceed storage temperature limits of –25 to +70°C (–13 to +158°F)

9.6 Services at Brüel & Kjær for Types 2250 and 2270

9.6.1 Accredited Calibration

For Types 2250 and 2270, you can order accredited calibration and choose between DANAK, A2LA, UKAS, Eichamt (Austria), RvA, ENAC, NATA and Inmetro.

For Spain, Primitiva is available.

The calibration will be performed in an ISO 17025 certified laboratory.

9.6.2 Initial Calibration

To start the measurement history from day one – if this is required, for example, for measurement use in public, for customer audit or quality procedures – we recommend you order accredited calibration together with the new analyzer.

9.6.3 Regular Recalibration

To fulfil requirements for public measurements and to minimise the cost of errors due to faulty or inaccurate measurements, we can arrange for calibration every year in an ISO 17025 certified laboratory at Brüel & Kjær. With annual data, you will have an unbroken history to use as reference, either for internal requirements, for audit required by authorities or at the request of your customers. And not least, you can follow the history of sensitivity for your analyzers over time.

9.6.4 Filter Calibration

- You can order calibration of filters. Please specify at the time of ordering
- Calibration of filter response for octave and 1/3-octave filters according to IEC 61260

9.6.5 Service and Repair

The hand-held analyzer is designed and constructed to provide many years of reliable operation. However, if a fault occurs that impairs the analyzer's correct function, then remove the battery pack and disconnect any external power supply to prevent risk of further damage.

For more information about preventing faults or damage to your analyzer, see section 9.5.

9.6.6 Hardware Maintenance and Repair

You can minimise the risk of unexpected costs by purchasing the hardware maintenance with a five years warranty. Minor repairs, such as those resulting from damage caused by unauthorised use of the analyzer, can be performed at the same time as the analyzer is being calibrated at Brüel & Kjær. This will save you time. If any other errors are detected by the technician during calibration, repair will be performed before returning the analyzer to you.

Repair is available at a fixed price, which includes a Conformance Test Certificate upon the return of your analyzer (no measurement data included).

9.6.7 Rental

To ensure optimal uptime, you can rent a substitute hand-held analyzer* while yours is being calibrated. To arrange rental, please contact your local Brüel & Kjær representative.

9.6.8 Training

Basic knowledge on sound and vibration measurement, analyzer training and application training are a few examples of what local training or consultancy hours[a] can do for you. To find out more about training and consultancy hours, please contact your local Brüel & Kjær representative.

* Providing this service is available from your local Brüel & Kjær office

Chapter 10

1/1- or 1/3-octave Frequency Analysis (Optional Module)

Frequency Analysis Software BZ-7223 enables you to make 1/1-octave or 1/3-octave measurements and broadband sound level measurements simultaneously.

Check the *About* screen to see whether you have the license to run the Frequency Analyzer. (To access the *About* screen, tap the **Help** icon ? then tap *About*.) See Chapter 9 for instructions on installing the license for the Frequency Analyzer.

10.1 Setting up the Analyzer

The Frequency Analyzer measures the following spectrum parameters together with full spectral statistics during timed measurements:

- L_{Xeq}
- L_{XFmax}
- L_{XSmax}
- L_{XFmin}
- L_{XSmin}

where X is the frequency weighting A, B, C or Z.

These spectra and the spectral statistics are saved in the project together with the measured sound level meter (broadband) parameters.

The spectral statistics can be viewed as L_{XYN} percentile spectra, where Y is the time weighting F or S and N can be one of 7 defined percentiles.

In addition, the instantaneous spectra L_{XF} and L_{XS} are always available.

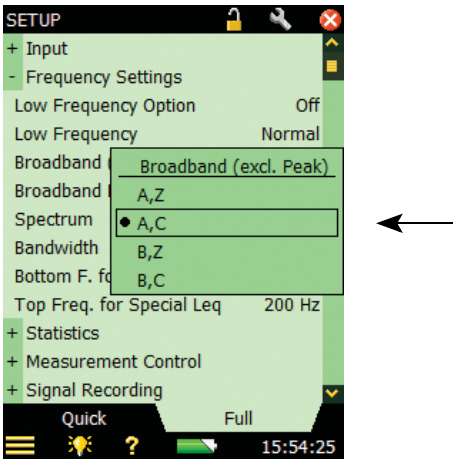
1) Select the **Frequency Analyzer** project template. (See section 3.3.1 for more details on templates.) The project template is displayed at the top of the screen, if it does not display **Frequency Analyzer**, tap the Project Template Bar at the top of the screen and select *Frequency Analyzer* from the drop-down that appears.

2) Tap the **Main Menu** icon and select *Setup* from the list of options. Set the *Broadband* and *Spectrum* parameter to A, B, C or Z, as required. (A/B-weighting is determined by setting the parameter in *Setup* > *Frequency Settings* > *Broadband (excl. peak)*.

   Set the *Bandwidth* parameter to 1/1-octave or 1/3-octave before making the measurement.

   To exit the screen, tap the icon.

Fig. 10.1
Setting the frequency weighting and bandwidth parameters



Under the *Signal Recording* parameters, select the settings for recording the signal while making the measurement. See Chapter 13 for more information.

Under the *Tone Assessment* parameters, select the settings for Tone Assessment. See Chapter 15 for more information.

10.2 Controlling the Measurement

The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

The measurement can control a generator connected to the Output socket on the connector panel (see Fig. 2.2 or Fig. 2.3). Enable the generator by setting the *Source* parameter to *Generator* in *Setup* > *Output Socket Signal*, then set up the generator settings in *Setup* > *Generator*. The generator will be controlled using *Escape Time* and *Build-up Time*, as described in Fig. 14.3.

10.3 Displaying the Results

The Frequency Analyzer measurement screen includes three tabs at the bottom: **Spectrum**, **Broadband** and **XL View** (Extra Large). The tabs allow you to choose different ways of displaying the measurement results. All but the **Spectrum** tab have been covered in Chapter 3. However, a quick recap is provided below.

The **Broadband** view shows an instantaneous L_{AF} readout, with associated bar graph and four measurement parameters, followed by two measurement setup parameters. (The first measurement parameter is displayed in a larger font size for better readability.)

The **XL View** increases the size of the first parameter readout to a 4 digit, full-screen display (including decimal point).

The **Spectrum** view, (which only appears as a tab if Frequency Analysis Software BZ-7223 is enabled), shows two different spectra parameters being measured simultaneously. In the example in Fig. 10.2, L_{ZFmax} and L_{ZF} are being viewed at the same time.

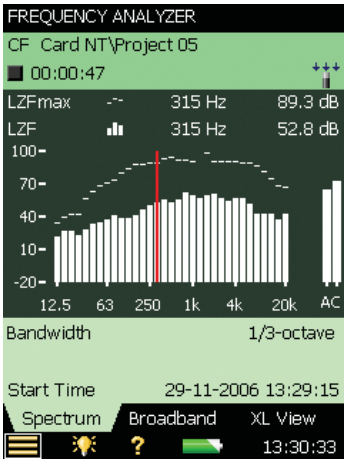
Note: The **Reference Spectrum** -- and **Main Spectrum** icons indicate which spectrum belongs to which parameter.

1) Select which spectra to view by tapping the parameter fields in the two lines above the spectrum display.

   These lines also include readouts of the spectrum values highlighted by the spectrum cursor. Tap the spectrum at the frequency of interest – or just tap anywhere in the spectrum area and then move the cursor to the position of interest using the **Left** ◄ and **Right** ► arrow pushbuttons.

   To the right of the spectrum, two broadband bars (of the same parameters) are also displayed.

Fig. 10.2
Displaying the results –spectrum screen

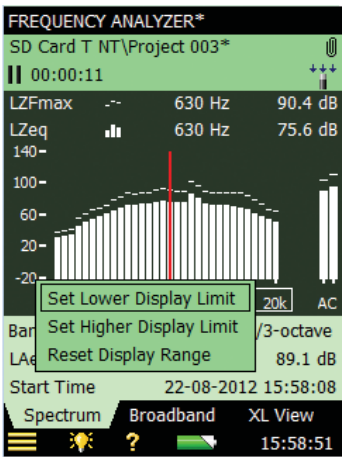


2) Adjust the X-axis (the horizontal frequency axis below the graphical display) by tapping on the scale and accessing the drop-down menu (Fig. 10.3):
   - use *Set Lower Display Limit* to set the lower frequency limit of the X-axis
   - use *Set Higher Display Limit* to set the upper frequency limit of the X-axis
   - use *Reset Display Range* to display all measured frequency bands

Note 1: These settings only affect the frequency range of the display of measured data, not the frequency range of the measurement itself.

Note 2: The Display range automatically resets if you change the filter Bandwidth setup parameter or change the *Low Frequency* setup parameter.

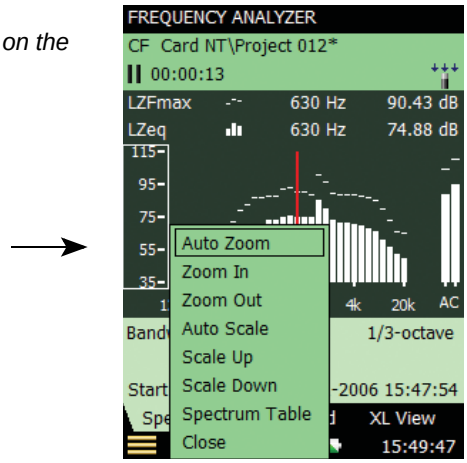
Fig. 10.3
Adjusting the X-axis



3) Scale the Y-axis (left-hand vertical scale of the graphical display) by tapping on the scale and accessing the drop-down menu (Fig. 10.4).

   Note: You can also select the spectrum cursor and press the **Accept** ✓ pushbutton.

Fig.10.4
Scaling the Y-axis on the Spectrum display



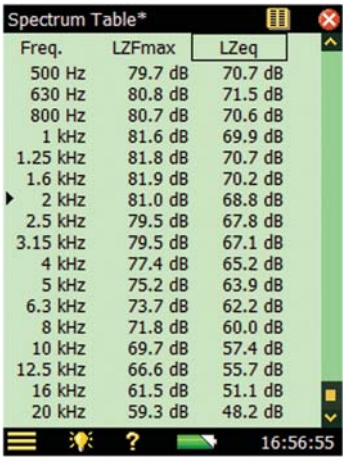
4) Select *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum.

5) Select *Zoom In*/*Zoom Out* to adjust the zoom.

6) Select *Scale Up/Scale Down* to adjust the full scale value on the Y-axis – or select *Auto Scale* to select the best scaling for viewing the spectra – without adjusting the zoom.

7) *Spectrum Table* shows the displayed part of the spectrum in tabular form – as in Fig.10.5. Press the **Table Format** icon at the top of the screen to select between three different viewing formats:
   - *Two Parameters*: for displaying values from both spectra
   - *One Parameter*: for displaying values from the main spectrum only (available for Reverberation Time Software only)
   - *One Parameter (wrap)*: for displaying values from the main spectrum only, but with the columns wrapped on the display to allow as many values as possible on the screen

Fig.10.5
Spectrum table



8) To exit the **Spectrum Table**, tap the icon.

9) *Auto Zoom* and *Auto Scale* automatically close the drop-down menu, otherwise, select *Close*, tap outside the drop-down list or use the **Left** arrow pushbutton to close the menu.

Hint: A quick way of auto zooming is to tap anywhere in the spectrum and then press the **Accept** pushbutton twice.

Note: Save the template, if you want to use the display settings for other measurements.

Some parameters are calculated based on the spectra:

- SIL, PSIL, SIL3 and L_{Xeq}(f1–f2) are calculated during the measurement and saved together with the other measurement data
- The Noise Parameters NC, NR, RC, NCB, Loudness and Loudness Level are for display only and calculated based on measured L_{Xeq} spectra. This means that whenever you have a L_{Xeq} spectrum you can also calculate and display these parameters
- NC, NR, RC and NCB are defined for 1/1-octave L_{Zeq} spectra, however, NC, NR, RC and NCB are calculated for any frequency weighting and any octave bandwidth. A-, B- and C-weighted spectra are converted to Z-weighted spectra and 1/3-octave spectra are converted to 1/1-octave spectra before the calculation
- Loudness and Loudness Level are calculated for 1/3-octave spectra with any frequency weighting. A, B and C weighted spectra are converted to Z-weighted spectra before the calculation

If 1/1-octave L_{Zeq} spectra have been measured, then you can display a Noise Curve together with the L_{Zeq} spectrum, see example in Fig. 10.6.

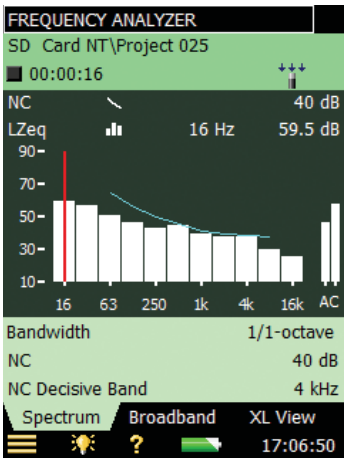


Fig. 10.6
Displaying a Noise Curve together with the L_{Zeq} spectrum

For RC and NCB you also have the possibility of displaying the limit curves for Rumble and Hiss, and for Rattle and Vibration together with the 1/1-octave L_{Zeq} spectrum.

10.3.1 Smileys

A smiley will be shown to the right of the project name if there are any issues with calculating noise parameters, or displaying noise curves (see the overview in Table 10.1).

Table 10.1 *Overview of Smileys*

Smiley	Explanation	Description
	No Loudness for 1/1-octaves	Select 1/3-octave
	No L_{eq} parameter logged	Select a L_{eq} spectrum for logging
	Sound Field Mismatch for Loudness	Set the *Loudness* parameter in *Input* in accordance with the *Sound Field Correction*
	Frequency bands outside Noise Curves	Levels are lower or higher than any noise curve band
	Noise Curves require use of Mic.	Select a microphone
	Display Noise Curve with L_{Zeq}	Noise parameters are calculated but Noise Curves can only be displayed together with L_{Zeq}
	Noise Curve for 1/1-octaves only	Noise parameters are calculated but Noise Curves can only be displayed for 1/1-octaves

10.4 Saving Results

Measurements are saved and can be viewed later, in the same way as described for the Sound Level Meter project in Chapter 3.

Chapter 11

Logging (Optional Module)

Logging Software BZ-7224 enables you to measure and save data periodically on SD or CF cards. You can also save to a USB memory stick with hardware version 4. The module is optimised for attended use, which means that while measuring you can annotate any sound online, as well as 'mark' up to five different sound categories online.

The main benefit is that data is documented on-site and is therefore ready for post-processing and reporting back at the office using Measurement Partner Suite BZ-5503 or other post-processing software such as Evaluator Type 7820, Protector Type 7825 or Microsoft® Excel®.

In addition to measuring broadband parameters (see Chapter 3) and spectra* (see Chapter 10), the Logging module allows you to simultaneously log the following parameters:

- Broadband parameters (including broadband statistics)
- Spectra* (including spectral statistics)
- Broadband parameters every 100 ms
- Record the measured signal†

An overview showing the options available during a typical logging task has been provided in Table 11.1.

Table 11.1 *Overview of options available during a typical logging task*

Selection	Period	Broadband Parameters	Broadband Statistics	Spectral Parameters	Spectral Statistics
Logged	1 s – 24 h	1 to 10 or All (45)	None or Full	0 – 3 or All (5)	None or Full
Logged (100 ms)	100 ms	None, L_{Aeq}, L_{AF} and/or L_{AS}	None available	None available	None available
Total	Elapsed Time	All (58)	Full	All (5)	Full

*. Requires Frequency Analysis Software BZ-7223
†. Requires Signal Recording Option BZ-7226

Check the *About* screen to see whether you have a license to run the Logging option. (To access the *About* screen, tap the **Help** icon then tap *About*.) See Chapter 9 for instructions on installing the license for the Logging option.

11.1 Setting up the Analyzer

1) Select the **Logging** project template. (See section 3.3.1 for more details on templates.) The project template is displayed on the black banner at the top of the screen. If this banner does not display **Logging**, tap the banner and select *Logging* from the drop-down that appears.

   Note: The Logging project template assumes you have a license for the Frequency Analysis Software. If not, then select the *LOGGING SLM* project template instead.

2) Depending on your memory device:
   - Insert an SD memory card in a SD card slot at the bottom of the analyzer
   - If you have hardware versions 1 – 3, you can insert a CF memory card in the CF card slot at the bottom of the analyzer
   - With hardware version 4, you can use a USB Type A stick at the bottom of the analyzer

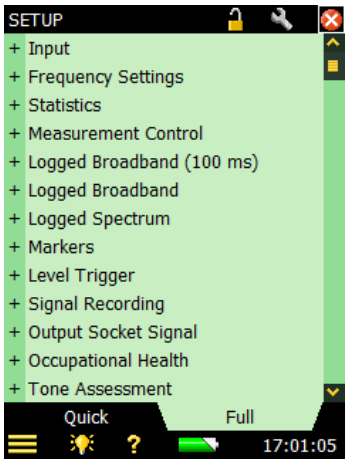
   You will be notified that a memory card has been inserted – select *Yes* to change the default measurement path to the memory card.

   Note: You cannot log data on the internal disk.

3) Tap the **Main Menu** icon and select *Explorer* from the list of options. Create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

4) Tap the **Main Menu** icon and select *Setup* from the list of options. The Setup screen will appear (Fig. 11.1). Set the *Input*, *Frequency Settings* and *Statistics* parameters as required for the Sound Level Meter and Frequency Analyzer measurements, see Chapter 3 and Chapter 10, respectively. These settings are common to both the logging and the total measurement.

Fig.11.1
The Setup screen



5) Under the *Measurement Control* parameters, set the *Measurement Time* and *Logging Period* as required. Set *Synchronize with clock* to *Yes* if you want the logging to synchronise with whole minutes or hours. For example, if *Logging Period* is set to 1 minute and you start the measurement at 8:12:33, then the first logging interval will be from 8:12:33 to 8:12:59 (27 seconds), the second will be from 8:13:00 to 8:13:59 (60 seconds), etc. Set *Synchronize with clock* to *No* if you want every logging interval to be the specified Logging Period exactly. Set *Charge Injection Calibration* to *On* if you want to validate the complete measurement chain by performing CIC at the start and end of the logging measurement, refer to section 5.10.

6) Under the *Logged Broadband* parameters, choose which broadband parameters you want to log in accordance with the *Measurement Control* parameters. You can choose to log *Full Statistics* per *Logging Period* or not. You can also choose to log *all* the measured *Broadband Parameters* or a *Selected* number of parameters. If you choose *Selected* then you can specify up to 10 parameters.

7) The *Logged Broadband (100 ms)* parameter allows you to log L_{Aeq}, with an elapsed time of 100 ms and a logging period of 100 ms, L_{AF} and/or L_{AS}, with a logging period of 100 ms, irrespective of the other logging parameters.

8) The *Logged Spectrum*[*] parameter allows you to choose which spectra to log. You can specify to log *All*, *None* or up to 3 *Selected* spectra. You can also choose to log *Full Spectral Statistics* per *Logging Period* or not.

*. Requires Frequency Analysis Software BZ-7223

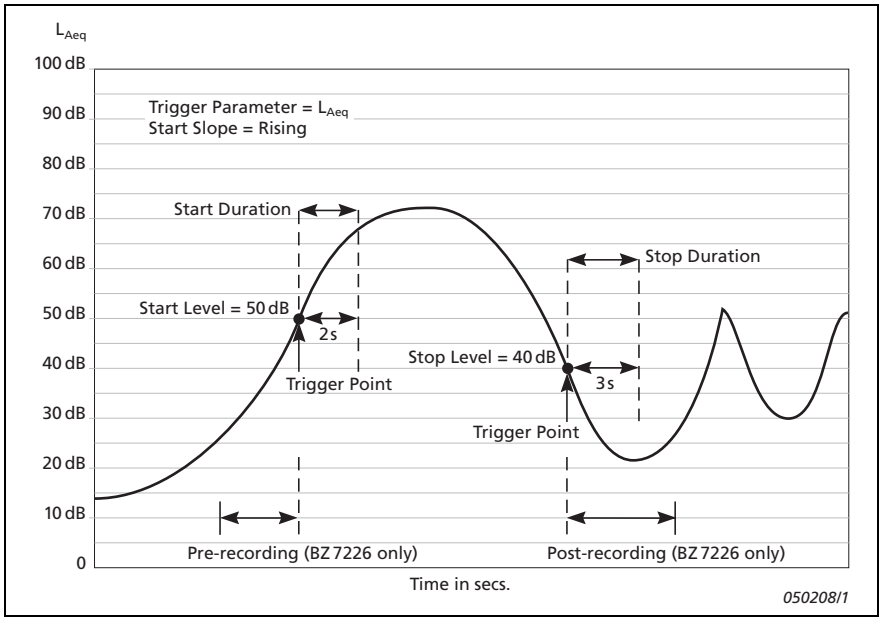
9) Under *Markers* you can specify the names of the five available markers. The markers are predefined as follows:
   - Marker 1: 'Exclude' – can be controlled by pressing the **Back-erase** pushbutton
   - Marker 2: 'Manual' – can be controlled by pressing the **Manual Event** pushbutton
   - Marker 3: 'Level' – can be controlled by the Level Trigger detection
   - Marker 4: 'Marker 4'
   - Marker 5: 'Marker 5'
   - Marker 6: 'Sound' – is set when recording signal (typically sound) – requires Signal Recording Software BZ-7226

   All markers can be controlled by the stylus in the **Profile** display.

   You can set a *Pre-marker Time* between 0 and 5 seconds. This will start markers 1, 2 or 3 the set number of pre-marker seconds before the point where the **Back-erase** pushbutton, the **Manual Event** pushbutton, or the **Level Trigger**, respectively, are pressed. See section 11.3.2.

10) Under the *Level Trigger* parameters, choose the settings for triggering the number 3 marker 'Level', for starting a signal recording and for sending an SMS or e-mail – see section 8.4 and Chapter 12:
   - Set *Level Trigger Control* to *On* to enable the level trigger facility or *Off* to disable the facility
   - Set *Trigger Parameter* to the parameter you want to monitor, for example, L_{Aeq} – see Appendix A for the total list of parameters
   - Set *Start Slope* to *Rising* if you want to start when the *Trigger Parameter* exceeds *Start Level* (and stop when it goes below *Stop Level*) or to *Falling* if you want to start when the *Trigger Parameter* goes below *Start Level* (and stop when it exceeds *Stop Level*)
   - Set *Start Duration* for the number of seconds the *Trigger Parameter* must fulfil the trigger condition before the trigger point is acknowledged
   - Set *Stop Duration* for the number of seconds the *Trigger Parameter* doesn't fulfil the trigger condition anymore to acknowledge the end point of the trigger (see the relationship between the trigger parameters in Fig. 11.2)

Fig. 11.2 *Relationship between trigger parameters*



11) Under the *Signal Recording* parameters, choose the settings for recording the signal while making a logging – see Chapter 12.

12) Under *Input* specify *Trigger Input* if you want to start the signal recording using an external trigger signal. See details in Appendix A.

To exit the screen, tap the icon.

11.2 Controlling the Measurement

The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

If you have set the *Charge Injection Calibration* parameter to *On*, then CIC is performed at the start of the measurement and at the end of the measurement. An Exclude marker is set on the logging profile at the point where CIC is being performed. The update of the *Total* parameters is stopped while CIC is being performed. You can see the results of the CIC under *Total* parameters, *CIC Result 1* and *CIC Result 2*.

11.2.1 Annotating a Project

While using the logging software you can annotate measurements using the normal method of adding annotations to a project, before or after a measurement, or while the measurement is paused. The annotations can then be viewed by tapping on the **Annotations** icon or tapping the **Main Menu** and selecting *Explorer* from the list of options. section 3.5.

However, if you choose to annotate the profile during the measurement, the Annotations icon will appear below the profile, not as a paperclip icon in the Status Field or attached to a project in **Explorer**, as described previously. In this case, you view the annotation using the method described in section 11.3.1.

11.2.2 Recording the Signal

You can record the input signal during the measurement* by pressing the **Manual Event** pushbutton (Manual Event marker), the **Back-erase** pushbutton (Exclude Marker) or when the level of a specific parameter exceeds a certain level – or you can record the signal through the whole measurement – depending on the *Signal Recording* setting on the Setup screen – details in Chapter 12.

11.3 Displaying the Results

The Logging Measurement screen (or **Profile** view) includes three tabs at the bottom: **Profile**, **Spectrum** and **Broadband** view (the Logging SLM includes the tabs: **Profile**, **Broadband** and **XL View**). The tabs allow you to choose different ways of displaying the measurement results. All but the **Profile** tab have been covered previously in Chapters 3 and 10, however a quick recap is provided below.

The **Broadband** view shows an instantaneous L_{AF} readout, with associated bar graph and a number of measurement parameters. (The first measurement parameter is displayed in a larger font size for better readability.)

The **XL View** increases the size of the first parameter readout to a 4-digit, full-screen display (including decimal point).

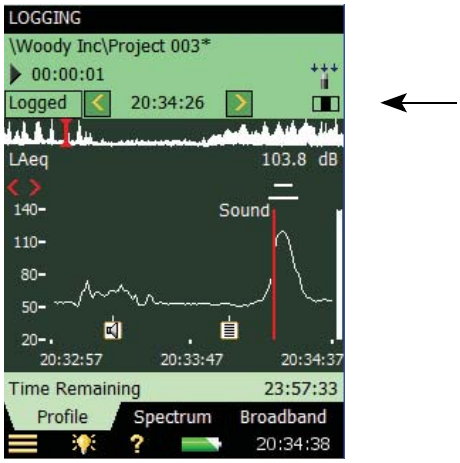
The **Spectrum** view shows two different spectra parameters being measured simultaneously.

11.3.1 The Profile View

The **Profile** view displays a profile of a logged broadband parameter (dB versus time). This is very convenient when marking sound categories on-line or annotating the measurement (Fig.11.3).

*. Requires License for Signal Recording Software BZ-7226

Fig. 11.3
Profile View (showing extended Status Field)



Status Field

The Status Field has been extended to include an extra line of information below the two existing lines of information covered previously in the Sound Level Meter and Frequency Analyzer (see Fig. 11.3).

This extra line of information allows you to:

- Select whether the results of the *Total* measurement from the *Logged* measurement, or from the *Logged(100 ms)* measurement are displayed. Select *Total* to display the measurement parameters of the Total measurement in all the views – the **Broadband** and **Spectrum** views will then display parameters or spectra similar to the Sound Level Meter or Frequency Analyzer. (The **Profile** view will be empty, because the Total measurement contains only a single set of parameters). Select *Logged* to display the measurement parameters from the logging intervals. The cursor in the profile selects which logging interval is displayed in all the views. Select *Logged(100 ms)* to display the L_{Aeq}, L_{AF} or L_{AS} in the profile from the 100 ms logging intervals. This setting does not display spectra or parameters in other views
- View the start time of the measurement (for *Total*) or the start time of the current logging interval (for *Logged* or *Logged(100 ms)* if measuring and the profile is not frozen) or the start time of the logging interval pointed out by the cursor. Tap the *Start Time* in any of the views to select data from another logging interval
- View whether the display of the profile during the measurement is frozen or not. When the icon is “animated” the display is being updated with new logged data during the measurement. You can freeze the display update by tapping on the icon. This also freezes the icon. Tap the icon again to unfreeze the display
- Step forwards or backwards through the logging intervals on all displays, using the and icons. (The icons are also connected to the profile cursor, so that any corresponding movement backwards or forwards through the intervals in one display will be reproduced in the other)

Some interaction with the display will automatically freeze and unfreeze the display (only while measuring):

- Tap the stylus on the profile. This will set the profile cursor and freeze the display update of the profile. You can move the cursor to any point in the profile by using the left and right arrow pushbuttons. The profile will be scrolled automatically, if necessary. Unfreeze by tapping on the icon
- Tap and hold the stylus on the profile display and drag it to the left or right. This will freeze the display and show two cursors. Next, remove the stylus from the display and a drop-down menu appears with the possibility of setting or editing a marker or annotation (see below). Select the required function from the drop-down menu. When the function has been carried out, the profile unfreezes automatically and progresses as it did before you tapped on the screen

The logged data are displayed as two profiles. The **Profile Overview** with the entire profile and the **Profile** with 100 logging samples.

The Profile Overview

An overview of the entire profile is displayed across the screen on the topmost part of the graph area.

The overview is based on $L_{Xeq,1s}$ (X = A or B depending on the *Broadband (excl. Peak) Frequency Settings* parameter). The Y-axis is auto-zoomed.

When you have logged for more than 4 minutes, then each pixel on the X-axis will cover more than 1 s. The overview will then display from the minimum $L_{Xeq,1s}$ to the maximum $L_{Xeq,1s}$ within the interval covered by the pixels on the X-axis.

Tap in the Profile Overview to select the part of the entire profile to display in the Profile below.

The Profile

The **Profile** displays a hundred samples of the logged data.

Select which parameter to view by tapping the parameter field in the line above the profile.

Markers are displayed between the profile and the profile parameter. Marker 1 (Exclude) is the topmost positioned marker. The name of the marker is displayed if the marker overlaps the cursor position. If a signal has been recorded, then a Sound Marker (Marker 6) is displayed above the profile – the marker covers exactly the time of the signal recording.

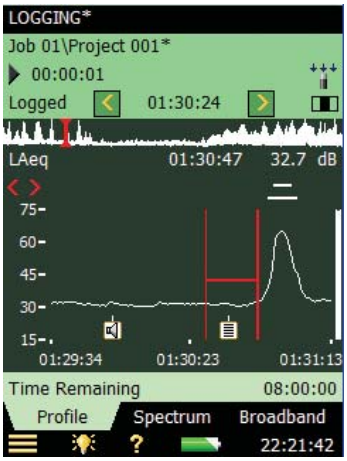
You can browse through markers using the buttons in the profile.

The whole, or any part of the signal recording can be played back, once or repetitively – see Chapter 12 for details.

To the right of the profile, the broadband parameter L_{AF} is displayed and updated regardless of the measurement status and the display freeze status.

Annotations are displayed below the profile as icons. To select an annotation, tap and hold the stylus at one side of the icon, just above it, then drag the stylus to the opposite side of the icon (so it looks like the example in Fig.11.4) and remove the stylus from the display.

Fig. 11.4
Selecting annotations



A drop-down menu appears, select the required function:

- *Open note* or *Play commentary*
- *Delete annotation*
- *Move annotation* (to the position on the display where the stylus was removed from the display)

Scale the Y-axis (left-hand vertical scale of the graphical display) by tapping on the scale and accessing the drop-down menu (as in the **Spectrum** display):

- Select *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum
- Select *Zoom In/Zoom Out* to adjust the zoom
- Select *Scale Up/Scale Down* to adjust the full scale value on the Y-axis - or select *Auto Scale* to select the best scaling for viewing the spectra – without adjusting the zoom
- *Auto Zoom* and *Auto Scale* automatically close the drop-down menu, otherwise, select *Close*, tap outside the drop-down list or use the **Left Arrow** pushbutton to close the menu

11.3.2 Marking Sound Categories

Use this facility to categorise the sound while you are measuring, or while you are observing the different kinds of sound on the display. This will make it much easier to do the post-processing and reporting back in the office.

You can mark up to five sound categories on-line. The markers are displayed as horizontal lines above the sound profile (Fig. 11.3). There are two main types of marker:

- An Exclude Marker – this allows you to mark a sound you want to exclude from your measurement later during post-processing or reporting. (It does not remove any data from your measurement)
- An Event Marker – this allows you to mark a particular sound of interest during your measurement

On the analyzer, Marker 1 is used as an Exclude Marker, while Markers 2 to 5 are used as Event Markers. All four event markers can be user-defined. You can define a marker by tapping on the Main Menu icon and selecting *Setup*, followed by *Markers*.

Marker 2 is set to a Manual Event marker by default – it can be controlled by the **Manual Event** pushbutton and the stylus.

Marker 3 is set to a Level Event marker by default – it can be controlled by the level trigger facility and the stylus.

Marker 6 is used as a Sound Marker and shows the size of the signal recording.

The analyzer allows you to view the markers at a later date by recalling the data and viewing the desired profile. (This can also be done if you have transferred the data to BZ-5503).

If required, Measurement Partner Suite BZ-5503, Evaluator Type 7820 and Protector Type 7825 can use the markers in their calculations. Marker number 1 (the Exclude Marker) will always be used as an Exclude Marker, while markers 2 to 5 will be used as defined in Type 7820 Evaluator/Type 7825 Protector software. The marker names, however, will be transferred from the analyzer. Marker 6 will be used as sound marker.

Marking During the Measurement

The measurement parameter is displayed as a progressing profile.

Use of Pushbuttons

Press the **Back-erase** pushbutton to start an Exclude Marker (marker number 1). The marker is displayed above the profile. Press the button once more to stop the Exclude Marker.

Press the **Manual Event** pushbutton to start a Manual Event Marker (marker number 2). The marker is displayed above the profile. Press the button once more to stop the Manual Event Marker.

Use of Stylus

Tap and hold the stylus on the profile display at the position where you want the marker to start. This will freeze the display and show a cursor at the position of the stylus. Then drag the stylus left or right to the position where you want the marker to end. This will display a second cursor. Next, remove the stylus from the display and a drop-down menu appears showing the five markers you have specified in the setup. Select the marker you require. The marker is displayed above the profile, the cursors disappear and the profile unfreezes and progresses as it did before you tapped on the screen.

Note: If you select Sound Marker, then the sound for this part will be recorded – see Chapter 12 for details.

Marking Measurement While it is Paused

The measurement parameter is displayed as a profile while the measurement is paused.

You can use the Stylus to Mark the Sound Categories

Tap and hold the stylus in the profile display at the position where you want the marker to start. This will display a cursor at the position of the stylus. Then drag the stylus left or right to the

position where you want the marker to end. This will display a second cursor. Next, remove the stylus from the display and a drop-down menu appears showing the five markers you have specified in the setup. Select the marker you require. The marker is displayed above the profile and the cursors disappear.

11.3.3 Editing Markers on Profiles

To widen a marker:

1) Tap and hold the stylus on the profile display at a position within the marker range.
2) Drag the stylus left or right to the position where you want the marker to end.
3) Remove the stylus from the display and a drop-down menu appears.
4) Select the marker you want to widen from the drop-down menu.

To narrow a marker:

1) Tap and hold the stylus on the profile display at the position inside the marker range where you want it to stop.
2) Drag the stylus left or right to a position outside the marker range.
3) Remove the stylus from the display and a drop-down menu appears.
4) Select *Delete* for the marker you want to narrow from the drop-down menu. The part where the marker overlaps the gap between the two cursors will be deleted.

To delete a marker:

1) Tap and hold the stylus in the profile display at a position to the left of the marker you want to delete.
2) Drag the stylus to a position to the right of the marker.
3) Remove the stylus from the display and a drop-down menu appears.
4) Select *Delete* for the marker you want to delete from the drop-down menu.

   Note: Sound markers cannot be edited. Marking the whole sound marker (or part of it) and selecting *Delete* will delete the whole sound marker and signal recording.

11.3.4 Annotate Sound Categories

You can annotate the measurement online with a spoken comment or a written note or (with Type 2270 only) an image. The annotation is displayed as an icon below the sound profile.

Annotating During the Measurement

The measurement parameter is displayed as a progressing profile.

Use of Pushbuttons

Press and hold down the **Commentary** pushbutton and talk to the analyzer to make your comment. Release the button when finished. This will insert a comment annotation in the profile at the time when the button was pressed.

Use of Stylus

Tap and hold the stylus in the profile display at the position where you want the annotation to start. This will freeze the display and display a cursor at the position of the stylus. Then drag the stylus a little to the left or right and raise it again. A drop-down menu appears and below the five markers you can select *Add Comment* or *Add Note* or *Add Image* to add a spoken comment or write a note or capture an image. When finished, the Comment or Note or Image is inserted in the profile, the cursors disappear and the profile unfreezes and progresses as before tapping on the screen.

Annotating While the Measurement is Paused

The measurement parameter is displayed as a profile while the measurement is paused.

Use of Stylus to Annotate the Sound

Tap and hold the stylus in the profile display at the position where you want the marker to start. This will display a cursor at the position of the stylus. Next, drag the stylus a little to the left or right and remove the stylus from the display. A drop-down menu appears and below the five markers you can select *Add Comment*, *Add Note* or *Add Image* (Type 2270 only) to add a spoken comment, write a note or capture an image. When finished the Comment, Note or Image is inserted in the profile and the cursors disappear.

Use of Pushbuttons

Using the **Commentary** pushbutton during a pause means that the comment annotation will be added to the project instead of the profile. (The annotations can be viewed by tapping on the paperclip icon or tapping the **Main Menu** and selecting *Explorer* from the list of options. See section 3.5.)

11.3.5 Editing Annotations on Profiles

To move an annotation:

1) Tap and hold the stylus on the profile display at a position on one side of the **Annotations** icon.

2) Drag the stylus through the **Annotations** icon to the position where you want the annotation moved to.

3) Remove the stylus from the display and a drop-down menu appears.

4) Select *Move Comment* (or *Move Note*, or *Move Image*) from the drop-down menu.

To delete an annotation:

1) Tap and hold the stylus on the profile display at a position to the left of the **Annotations** icon you want to delete.

2) Drag the stylus to a position to the right of the annotation.

3) Remove the stylus from the display and a drop-down menu appears.

4) Select *Delete* for the annotation you want to delete from the drop-down menu.

11.4 Saving and Recalling Results

Measurements are saved and can be viewed later, in the same way as described for the Sound Level Meter project in Chapter 3 and Chapter 6.

Chapter 12

Enhanced Logging (Optional Module)

Enhanced Logging Software BZ-7225 enables you to measure and save data periodically on memory cards. You can also save to a USB memory stick with hardware version 4. The module is optimised for unattended use, which means that the module will measure and save data in an efficient way, without the requirement for an operator to be present.

In addition to measuring broadband parameters (see Chapter 3) and spectra* (see Chapter 10), it simultaneously logs the following parameters (see Chapter 11):

- Broadband parameters (including broadband statistics)
- Broadband parameters every 100 ms
- Spectra[a] (including spectral statistics)
- Record the measured signal†

Finally, the Enhanced Logging module can also log with a different period (periodic reports –for example, every hour) for reporting:

- Broadband parameters (including broadband statistics)
- Spectra* (including spectral statistics)

The Enhanced Logging module can measure continuously, limited only by data memory and power supply. An overview showing the options available during a typical enhanced logging task has been provided in Table 12.1.

*. Requires Frequency Analysis Software BZ-7223
†. Requires Signal Recording Option BZ-7226

Table 12.1 *Overview of options available during a typical enhanced logging task*

Selection	Period	Broadband Parameters	Broadband Statistics	Spectral Parameters	Spectral Statistics
Logged	1 s – 24 h	1 to 10 or All (45)	None or Full	0 – 3 or All (5)	None or Full
Logged (100 ms)	100 ms	None, L_{Aeq}, L_{AF} and/or L_{AS}	None available	None available	None available
Periodic Reports	1 m – 24 h	All (53)	Full	All (5)	None or Full
Total	Elapsed Time	All (67)	Full	All (5)	Full

Check the *About* screen to see whether you have a license to run Enhanced Logging. (To access the *About* screen, tap the **Help** icon then tap *About*.) See Chapter 9 for instructions on installing the license for the Enhanced Logging option.

12.1 Setting up the Analyzer

1) Select the **Enhanced Logging** project template. (section 3.3.1 for more details on templates.) The project template is displayed on the black banner at the top of the screen. If this banner does not display **Enhanced Logging**, tap the banner and select *Enhanced Logging* from the drop-down that appears.

2) Depending on your memory device:
   - Insert an SD memory card in a SD card slot at the bottom of the analyzer
   - If you have hardware versions 1 – 3, you can insert a CF memory card in the CF card slot at the bottom of the analyzer
   - With hardware version 4, you can use a USB Type A stick at the bottom of the analyzer

   You will be notified that a memory card has been inserted – select *Yes* to change the default measurement path to the memory card.

   Note: You cannot log data on the internal disk.

3) Tap the **Main Menu** icon and select *Explorer* from the list of options. Create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

4) Tap the **Main Menu** icon and select *Setup* from the list of options. Set up the measurement as described for Logging in Chapter 11, steps 4 to 12.

5) Under the *Measurement Control* parameters:
   - Set the *Save Project Data at*, *Continuous Logging* and *Report Period* as required
   - Select whether or not you want to save the *Full Spectral Statistics* for Reports

Note: All other measured broadband and spectral parameters are logged automatically per report period.

Then you can select:

- *Number of CICs*
- Desired time periods for calibration

6) Under the *Logged Spectrum* parameters, you can choose to log *Full Spectral Statistics* per *Logging Period* or not.

   Note: Logging the full spectral statistics at a short logging period (for example, every second) takes up a lot of space on the memory card.

7) Under *Triggers*, you can specify a *Signal Recording Timer* for periodically starting a signal recording (for example, five minutes per hour) and you can specify up to four independent *Level Triggers* to be active at four different times during the day. Each level trigger works as specified in section 11.1. In addition, you can specify a *Hold Off* period – this means that during this period, new triggers are inhibited. You also have the ability to trigger L_{Xeq}(f1–f2).

   Note: You can trigger on a specific frequency band by setting *f1 = f2*.

8) Under L_{den} *Periods* parameters you can set up the day, evening and night periods and the penalties in accordance with your local legislation.

To exit the screen, tap the icon.

12.2 Controlling the Measurement

The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

However, during the measurement, data are automatically saved in projects, one per day. The projects are automatically saved at the time specified in the *Save Project Data at* parameter in *Setup > Measurement Control*. The next project is (automatically) started immediately after the first one, without any data loss.

Note: When *Preset Logging Time* has elapsed, or you pause the measurement, then the project will not be saved automatically. This has to be done manually.

In the case of power failure, or other failures, the software is rebooted automatically. This means that the measurement data collected up until the time of the reboot is saved in a project and a new measurement is started. The new measurement is started in a new project.

The projects are named as specified in *Preferences > Storage Settings.*

Example: If you select *Auto-naming of Projects*, and start the measurement on the 13th of November, then your projects for measuring 48 hours (assuming you have started in the middle of the day, and have set *Save Project Data at* parameter to *00:00:00*) will be:

051113 001 (containing data from the middle of the day November 13th until midnight)

051114 001 (containing data for a whole day – November 14th)

051115 001 (containing data from midnight to the middle of the day on November 15th)

If you did not select *Auto-naming of Projects* then you would have the following projects (assuming the *Project Name Prefix* parameter was set to *Project* and no projects had been saved before in the directory):

Project 001

Project 002

Project 003

If you have set the *Charge Injection Calibration* parameter to *On*, then a CIC calibration is performed at specified times of the day. An Exclude marker is set on the logging profile at the point where the CIC is being performed. The update of the *Total* parameters and the Periodic Reports is stopped while the CIC is being performed. You can see the results of the CIC calibration under *Total* parameters, *CIC Result 1* to *4*.

The CIC result can be either '*Passed*', '*Background noise too high*' or '*CIC Ratio deviates from Ref.*' (The '*Ref.*' mentioned here is the reference created by the very first manual CIC, and is the one used as the reference to all subsequent CIC ratio measurements, see section 5.10.)

Note: If a level trigger is active when the CIC is due to start, then the CIC will not be done.

12.2.1 Annotating a Project

Measurements can be annotated in the same way as you annotate Logging measurements. See section 11.2.1.

12.2.2 Recording the Signal

Signal recordings can be done in the same way as described under Logging measurements. See section 11.2.2.

12.3 Displaying the Results

The Enhanced Logging Measurement screen includes three tabs at the bottom: **Profile**, **Spectrum** and **Broadband** view – as the Logging Measurement screen does. You view data in the same way as in the Logging module. You mark and annotate sound categories and edit markers and annotations in the same way as in the Logging module – please see Chapter 11.

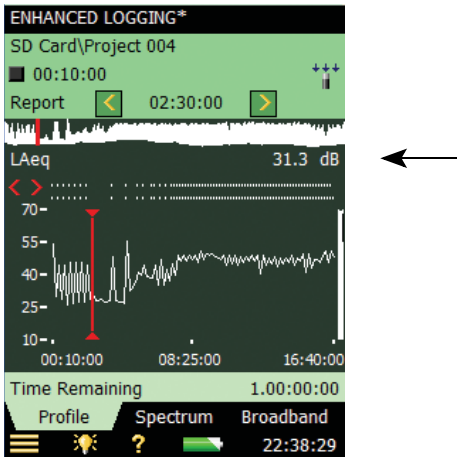
The Result Selector (first item in the third line of the Status Field) determines whether results from the *Total, Logged, Logged (100 ms)* or *Report* measurement are displayed.

If you need to display data from another day of the measurement, then use Explorer to select and open the project from that day.

12.3.1 The Profile View

The **Profile** view displays a profile of a logged broadband parameter (dB versus time). See Fig. 12.1.

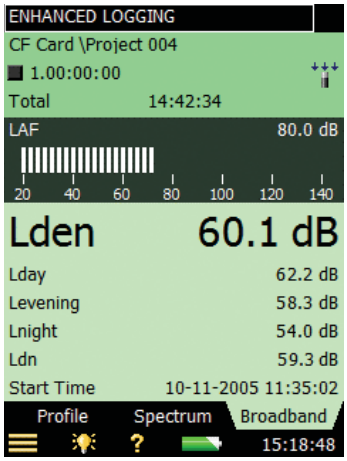
Fig. 12.1
Profile view in Enhanced Logging



12.3.2 Displaying Noise Indicators

The L_{den} and L_{dn} parameters are displayed in the **Broadband** view when selecting *Total* in the Result Selector. Then select the *Noise Indicators* from the L_{eq} parameter group. See Fig. 12.2.

Fig. 12.2
Noise Indicators



12.3.3 Saving and Recalling Results

Measurements are saved and can be viewed later, in the same way as described for the Sound Level Meter Project in Chapter 3 and Chapter 6.

Chapter 13

Signal Recording Option

Signal Recording Option BZ-7226 allows you to record the input signal (typically sound) in either 16-bit or 24-bit resolution during measurement (24-bit for BZ-7222/23/24/25/30/33 only). The signal recording can be controlled manually or by using an external trigger signal. The recording can also be triggered when a measured parameter exceeds a preset level (BZ-7224 and BZ-7225 only). The recorded sound can be played back and listened to using the supplied Earphones HT-0015. Sound is recorded directly to a memory card. With hardware version 4, sound can also be recorded to a USB memory stick.

The main benefit is that data is documented on-site and is therefore ready for post-processing and reporting back at the office using Measurement Partner Suite BZ-5503 or other post-processing software such as Evaluator Type 7820, Protector Type 7825 or Microsoft® Excel®.

Check the *About* screen to see whether you have a license to run the Signal Recording option. (To access the *About* screen, tap the **Help** icon ? then tap *About*.) See Chapter 9 for instructions on installing the license for the Signal Recording option.

13.1 Sound Level Meter and Frequency Analysis Software

You can use the Signal Recording facility together with the Sound Level Meter Software and the Frequency Analysis Software. You can record the sound for the whole measurement period or you can record sound for controlled parts of the measurement. The recordings are attached to the project as annotations, named “Soundrec N”, where N is the number of the recording for the project. (section 3.5 and section 6.3.2 for a description of how to use annotations.)

Note 1: Signal recordings can only be done during measurements.

Note 2: Signal recordings can only be done on projects saved on memory cards (or with hardware version 4, from a USB memory stick).

13.1.1 Setting up the Analyzer

1) Select a **Sound Level Meter** project template or a **Frequency Analyzer** project template. (see section 3.3.1 for more details on templates.)

2) Depending on your memory device:
   - Insert an SD memory card in a SD card slot at the bottom of the analyzer
   - If you have hardware versions 1 – 3, you can insert a CF memory card in the CF card slot at the bottom of the analyzer
   - With hardware version 4, you can use a USB Type A stick at the bottom of the analyzer

   Note: You cannot record the signal on the internal disk.

3) Tap the **Main Menu** icon and select *Explorer* from the list of options. Navigate to the memory card, create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

4) Tap the **Main Menu** icon and select *Setup* from the list of options. Set all the parameters as required for the Sound Level Meter or Frequency Analyzer measurement, see Chapter 3 and Chapter 10, respectively.

5) Under *Signal Recording* you can specify the *Recording Control* parameters as follows:
   - *Automatic*, if you want to start the recording when you start the measurement and stop when you pause the measurement, and to limit the recording to *Maximum Duration*, if *Duration Limit* is set to *On*
   - *Manual Event*, if you want to start and stop the recording using the **Manual Event** pushbutton during the measurement and to limit the duration of the recording, if *Duration Limit* is set to *On*. In this case the recording will be at least *Minimum Duration* long, but no longer than the *Maximum Duration*. Use *Pre-recording Time* and *Post-recording Time* to specify how much extra you want to be recorded before and after the event
   - *External Event*, if you want to start and stop the recording using an external trigger signal, connected to the Trigger Input. See details in Appendix A
   - *Image Event* (Type 2270 only), if you want to make a short recording together with capturing an image. The recording will be "Pre-recording Time + Post-recording Time + 1" second long. See details in Appendix A
   - *Off*, if you do not want to record the signal

6) Set *Recording Quality* to *High*, *Medium*, *Fair* or *Low* in accordance with your needs. **Note:** High quality requires more disk space than low quality – details in Appendix A.

7) Set *Recorded Signal* to either *Input A/B-weighted*, *Input C-weighted* or *Input Z-weighted* (A/B-weighting is determined by setting the parameter in *Setup > Frequency Settings > Broadband (excl. Peak)*). Input C-weighted is suitable for recordings used afterwards to identify the sound source – it contains all the audible content of the signal, but reduces the low-frequency noise from wind, etc.

8) Set *Automatic Gain Control* to *On* – if you just want to listen to the signal afterwards. The full 120 dB dynamic range (from max. input level and down) will be converted to 40 dB and the signal is stored as a 16-bit WAV file.

   Set *Automatic Gain Control* to *Off* – if you need to record calibrated signals or need to analyze the wav-file afterwards on a PC. Select *Resolution = 24 bit* (recommended) to cover the full 120 dB dynamic range (from max. input level and down) or select *Resolution = 16 bit* and specify the *Peak Recording Level*.

9) Under *Input* you specify *Trigger Input* if you want to start the signal recording using an external trigger signal. See details in Appendix A.

To exit the screen, tap the icon.

13.1.2 Controlling the Recording

The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start**/**Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 3 for more details.

When the measurement signal is being recorded, the **Recording** icon is displayed in the Status Field. The recording is attached to the project as an annotation. The annotations icon is then displayed to indicate that the project has been annotated.

When *Recording Control* is set to *Automatic*, the recording will start when the measurement is started and last for the *Maximum Duration* or the *Elapsed Time*, whichever is smallest. If you continue a paused measurement, then a new recording is started.

When *Recording Control* is set to *Manual Event*, the recording will start the first time you press the **Manual Event** pushbutton during the measurement, and stop the second time you press it; if you press it a second time before the *Minimum Duration* has elapsed, then the recording will continue until *Minimum Duration* has elapsed; if you press it a second time after *Maximum Duration* has elapsed, then the recording has already been stopped when *Maximum Duration* elapsed and the pushbutton will initiate a new recording instead.

When *Recording Control* is set to *External Event*, and *Trigger Input* is set to *Voltage Level*, then recording is started when the voltage level is 'high' and stopped when voltage level is 'low' (details in Appendix A). *Duration Limit* has no effect on this setting.

When *Recording Control* is set to *Image Event* (Type 2270 only), then you will record 1s plus the Pre- and Post-recording Time.

If *Pre-recording Time* has been set, then the recording will start this time before you hit the **Manual Event** pushbutton. This is possible because the recording is done continuously in an internal buffer, ready to be saved as a wave file. The *Pre-recording Time* is limited by this buffer size and the Recording Quality – details in Appendix A.

Note: Very long signal recordings will be split into wave files containing maximum 10 minutes, that is, a 35-minute signal recording will consist of 4 wave files, three with 10 minutes of sound and one with 5 minutes of sound.

13.1.3 Playing the Recording

Signal recordings are attached to the measurement project as annotations. The annotations icon is displayed in the Status Field to indicate this. Tap the paperclip to open the list of annotations. Tap the annotation to play it back – details in Chapter 3 and Chapter 6.

13.2 Logging and Enhanced Logging Software

You can use the Signal Recording facility together with the Logging and Enhanced Logging Software. You can record the sound for the whole measurement period or you can record sound for controlled parts of the measurement. The recordings are attached to the profile as sound markers. The signal recordings can be controlled by the **Manual Event** pushbutton, the **Back-erase** pushbutton, an external trigger signal, or by the level of the measured signal. You can also control the signal recording using the stylus to mark the interesting part on the profile.

Note 1: Signal recordings can only be done during measurements.

Note 2: Signal recordings can only be done on projects saved on memory cards (or with hardware version 4, from a USB memory stick).

13.2.1 Setting up the Analyzer

1) Select a Logging, Logging SLM or Enhanced Logging Project Template. (see section 3.3.1 for more details on templates.)

2) Depending on your memory device:
   - Insert an SD memory card in a SD card slot at the bottom of the analyzer
   - If you have hardware versions 1 – 3, you can insert a CF memory card in the CF card slot at the bottom of the analyzer
   - With hardware version 4, you can use a USB Type A stick at the bottom of the analyzer

   Note: You cannot record the signal on the internal disk.

3) Tap the **Main Menu** icon and select *Explorer* from the list of options. Navigate to the memory card, create a job folder for the measurements and set the default measurement job/path as described in Chapter 6.

4) Tap the **Main Menu** icon and select *Setup* from the list of options. Set all the parameters as required for the Logging or Enhanced Logging measurement, see Chapter 11 or Chapter 12, respectively.

5) Under *Signal Recording* you can specify the *Recording Control* parameters as follows:
   - *Automatic*, if you want to start the recording when you start the measurement and stop when you pause the measurement, and to limit the recording to *Maximum Duration*, if *Duration Limit* is set to *On*
   - *Manual Event*, if you want to start and stop the recording using the **Manual Event** pushbutton during the measurement

- *Exclude Event*, if you want to start and stop the recording using the **Back-erase** push-button during the measurement
- *External Event*, if you want to start and stop the recording using an external trigger signal, connected to the Trigger Input
- *Level Event*, if you want to start and stop the recording based on the level trigger settings during the measurement
- *All Events*, if you want to start and stop the recording based on any of the events

  Note: When *Recording Control* set to any of the events, you can limit the duration of the recording, if *Duration Limit* is set to *On*. In this case the recording will be at least *Minimum Duration* long, but no longer than the *Maximum Duration*. Use *Pre-recording Time* and *Post-recording Time* to specify how much extra you want to be recorded before and after the event
- *Image Event* (Type 2270 only), if you want to make a short recording together with capturing an image. The recording will be "Pre-recording Time + Post-recording Time + 1" seconds long. See details in Appendix A
- *Off*, if you do not want to record the signal

6) Set *Recording Quality* to *High*, *Medium*, *Fair* or *Low* in accordance with your needs.

   Note: High quality requires more disk space than low quality – details in Appendix A.

7) Set *Recorded Signal* to either *Input A/B-weighted*, *Input C-weighted* or *Input Z-weighted* (A/B-weighting is determined by setting the parameter in *Setup > Frequency Settings > Broadband (excl. Peak)*). Input C-weighted is suitable for recordings used afterwards to identify the sound source – it contains all the audible content of the signal, but reduces the low-frequency noise from wind, etc.

8) Set *Automatic Gain Control* to *On* – if you just want to listen to the signal afterwards. The full 120 dB dynamic range (from max. input level and down) will be converted to 40 dB and the signal is stored as a 16-bit wav-file.

   Set *Automatic Gain Control* to *Off* – if you need to record calibrated signals or need to analyze the wav-file afterwards on a PC. Select *Resolution = 24 bit* (recommended) to cover the full 120 dB dynamic range (from max. input level and down) or select *Resolution = 16 bit* and specify the *Peak Recording Level*.

Under *Input* you specify *Trigger Input* if you want to start the recording using an external trigger signal. See details in Appendix A.

To exit the screen, tap the icon.

13.2.2 Controlling the Recording

The measurement is controlled in the same way you would control a normal logging measurement, using **Start/Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 11 for more details.

When the measurement signal is being recorded, then the **Recording** icon is displayed in the Status Field. The recording is attached to the profile as a Marker 6 (Sound).

If you set *Recording Control* to *Automatic*, the recording will start when the measurement is started and last for *Maximum Duration* or *Elapsed Time*, whichever is smallest. If you continue a paused measurement, then a new recording is started.

If you set *Recording Control* to *Manual Event*, the recording will start the first time you press the **Manual Event** pushbutton during the measurement (this starts a Manual Event marker and a Sound marker), and stop the second time you press it; if you press it a second time before *Minimum Duration* has elapsed, then the recording will continue until *Minimum Duration* has elapsed; if you press it a second time after *Maximum Duration* has elapsed, then the recording has already stopped when *Maximum Duration* elapsed, and the pressing the button will have no effect on the signal recording (the Manual Event marker, however, is stopped).

If you set *Recording Control* to *Exclude Event*, the recording will start the first time you press the **Back-Erase** pushbutton during the measurement (this starts an Exclude Event marker and a Sound marker), and stop the second time you press it – the behaviour will be similar to control by the **Manual Event** pushbutton.

When *Recording Control* is set to *External Event*, and *Trigger Input* is set to *Voltage Level*, then recording is started when the voltage level is 'high' and stopped when voltage level is 'low' (details in Appendix A). *Duration Limit* has no effect on this setting.

If you set *Recording Control* to *Level Event*, the recording will start, controlled by the level trigger – see Chapter 11 for details.

When *Recording Control* is set to *Image Event* (Type 2270 only), then you will record 1s plus the Pre- and Post-recording Time

If you set *Recording Control* to *All Events*, the recording will start when any of the events above become active, and stop when all events are inactive again.

If *Pre-recording Time* has been set, then the recording will start this time before the Event appears. This is possible because the recording is done continuously in an internal buffer, ready to be saved as a wave file. The Pre-recording Time is limited by this buffer size and the Recording Quality – details in Appendix A.

Note: Very long signal recordings will be split into wave files containing maximum 10 minutes, that is, a 35-minute signal recording will consist of 4 wave files, three with 10 minutes of sound and one with 5 minutes of sound.

13.2.3 Control Recording using the Stylus

If *Recording Control* is set to any of the events, or to *All Events*, the recording can also be controlled using the stylus directly on the profile, in the same way as you mark sound categories – details in Chapter 11.

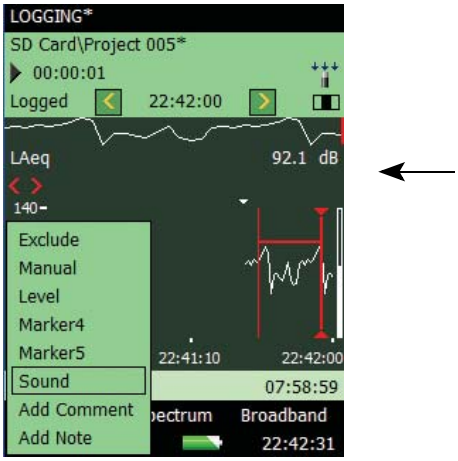


Fig.13.1
Example Logging display (showing internal buffer marker)

The small triangle above the profile indicates the amount of sound you have in the internal buffer – ready for storage in a wave-file. You will have sound from this triangle to the right-hand side of the profile. The triangle is updated every second.

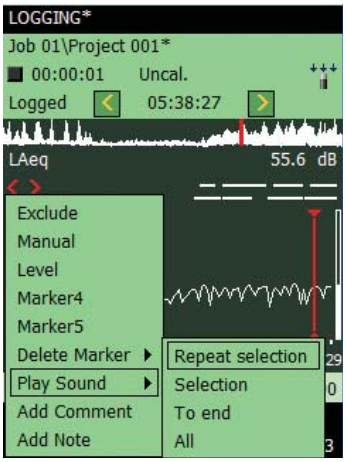
To make a signal recording using the stylus, you tap and hold the stylus on the profile display and drag it to the position where the signal recording should end, then you remove the stylus and get a drop-down menu with the possibility of setting one of the six markers. If you select *Sound*, then a sound marker is made and the sound for the marked interval is stored in a wave file. Only the portion of the sound available in the internal buffer (to the right of the small triangle) will be stored and the sound marker will only indicate this part.

Note: When selecting an interval for storing (or setting a marker), the profile display freezes, but the signal recording is still updated in the internal buffer. The part of the buffer available on the screen will decrease and you will see the small triangle move to the right. Be sure not to wait too long in selecting the *Sound marker* from the drop-down menu – otherwise the signal recording will disappear from the internal buffer.

13.2.4 Playing the Recording

You playback the sound simply by selecting part of the marker – as described in section 11.3.3 – and choose *Play Sound* from the resulting drop-down menu. The following drop-down menu will then appear (Fig.13.2).

Fig. 13.2
Playing the recording – the drop-down menu



Select one of the four ways of playing a sound: *Selection* will play the part you have selected; *Repeat Selection* will play the selected part until you press *Cancel* on the pop-up menu; *To End* will play the sound from the position you selected the sound marker to the end; and finally *All* will play the entire signal recording, regardless of your selection point.

Fig. 13.3
Playing the recording – output level pop-up

When you have selected the method of play-back, a pop-up appears explaining how to adjust the output level in the headphone and how to stop the play-back.

Tap the **Minimize** button to reduce this to a small blue bar at the top of the screen – allowing you to watch the profile underneath – you will notice that the profile cursor is updated every second to the position of the sound that is currently being played.

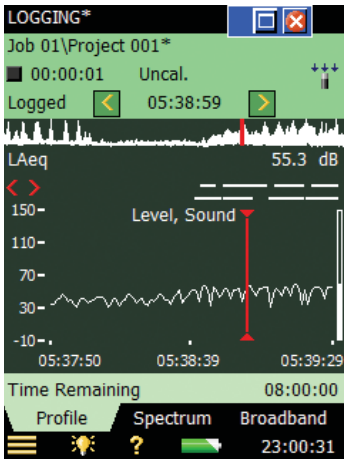


Fig.13.4
Playing the recording – minimizing the pop-up

The small blue button bar at the top can be maximized again by tapping the icon, or you can close it and stop playing back by tapping the icon.

13.2.5 Signal Recordings on the PC

When projects including signal recording have been transferred into an Archive on a PC using BZ-5503, then the recordings can be played back directly from BZ-5503.

Signal Recordings can be input to the Brüel & Kjær PULSE Multi-Analyzer platform for further analysis – please contact your local Brüel & Kjær representative for further information.

Note: When recording signals for further analysis in PULSE, be sure to record the Z-weighted signal and select *Automatic Gain Control* to *Off* under the *Signal Recording* parameters and select the *Recording Quality* to match your needs for frequency content – see details on sampling frequency in Appendix A.

When *Automatic Gain Control* is set to *Off*, then the calibration information is stored in the wave files – allowing PULSE to analyse the signal recordings, taking the calibration into account.

Note: Other sound players than BZ-5503 might not be able to amplify “24-bit per sample” wav-files enough to hear weak sounds. If this is needed, then use 16-bits per sample.

Chapter 14

Reverberation Time Software (Optional Module)

14.1 Introduction

Reverberation Time Software BZ-7227 enables you to measure reverberation time in 1/1-octave or 1/3-octave.

Check the *About* screen to see whether you have a license to run Reverberation Time Software. (To access the *About* screen, tap the **Help** icon ? then tap *About*.) See Chapter 9 for instructions on installing a license for Reverberation Time Software.

14.1.1 Definition

Reverberation Time (RT) is the most important parameter describing the acoustic quality of a room or space. It is important for sound levels, speech intelligibility and the perception of music. In addition, it is used to correct for the effects of RT on building acoustics and sound power measurements.

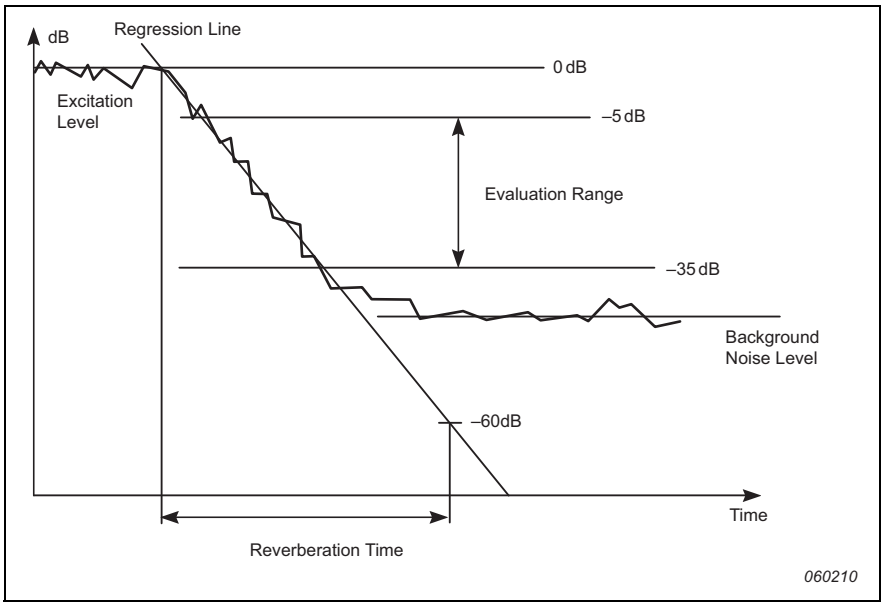
RT is the decay time for sound in a room after the excitation stops. It is the time for a 60 dB drop in level, but the decay is usually evaluated over a 10, 20 or 30 dB drop, using the measurements within these ranges to make a regression line, which is then extrapolated to the 60 dB range (Fig. 14.1).

RT may be labelled EDT, T20 and T30 respectively for those three evaluation ranges. EDT is used in room acoustics only, while T20 and T30 may be used for Building Acoustics, Sound Power and Absorption Coefficient measurements as well.

RT is measured in 1/1- or 1/3-octave frequency bands, some of which may be averaged to provide a single-number result for the most significant bands.

RT may range from 0.1 seconds (or less) in anechoic chambers, to 10 or more seconds in large public spaces.

Fig. 14.1 *Definition of Reverberation Time (RT). Evaluation range of 30 dB for calculation of T30 indicated*



RT varies between positions in a room, so it is usually measured at several positions. The spatial average (Room average) for all positions gives an overall assessment, and the position results may be used to indicate the acoustic quality as a function of location.

The Room average can either be made as an average of the RT spectra, or calculated for the averaged decays (ensemble average), that is: the decays for each frequency band are averaged over all positions and the RT spectrum is then calculated for the averaged decays.

14.1.2 How Do We Measure Reverberation Time?

RT can be measured using either Interrupted Noise, with the built-in noise generator, or by using Impulsive Excitation (Schroeder Method), such as from a pistol or balloon burst.

Interrupted Noise Method

When using a power amplifier and loudspeaker sound source (Fig. 14.2), the analyzer will turn its noise generator on and off, then measure and display the RT spectrum and decays.

Fig. 14.2 *Typical RT measurement setup using a loudspeaker source*

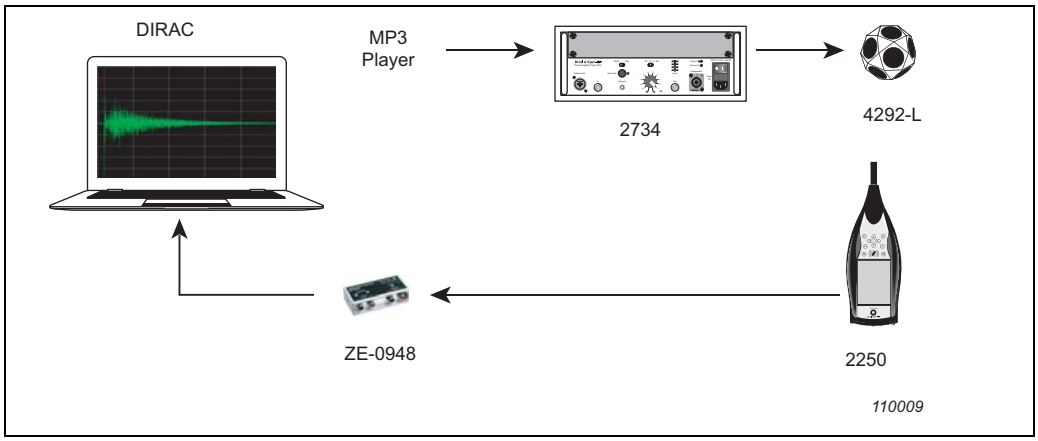


Fig. 14.3 *Typical RT measurement cycle for the interrupted noise method*

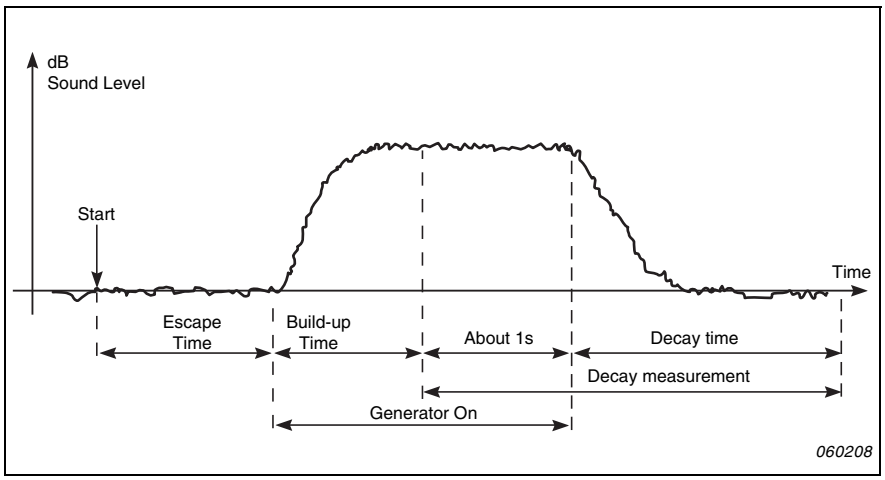


Fig. 14.3 shows a typical RT measurement cycle automatically performed by the analyzer, where the different steps are described as follows:

1) After 'Start', there is a chosen 'Escape Time' which allows for vacating the measurement site.

2) The noise generator is then switched on and waits for the chosen 'Build-up' time to allow for a steady state to be reached.

3) The decay measurement starts. The level for the first second, or so, (labelled 'About 1s' on Fig. 14.3) is used to identify the excitation sound level as the 0 dB reference level.

4) The noise generator is switched off and the 'Decay time' starts.

5) The decay measurement ends when only the background noise level is measured (automatically detected by the analyzer).

6) Steps 2 to 5 are automatically repeated a chosen number of times and the measured decays are averaged together to reduce the uncertainty of the measurement.

7) The reverberation time spectra EDT, T20 and T30 are calculated and displayed on the screen.

The measurement can be in octaves or 1/3-octaves in parallel over a selectable frequency range, allowing you to focus sound power on the relevant range. In each frequency band, the decay is sampled 200 times each second, for reverberation times as long as 20 seconds.

You can enhance the signal-to-noise ratio by limiting the frequency range of the noise to cover just a single frequency band, while keeping the output power constant. First, you make a parallel measurement, then, if the signal-to-noise ratio is too low in a few bands (typically at low frequencies) you select these bands for serial measurements. You can redo the measurements including only these bands and merge the results with the parallel measurement.

Impulsive Excitation Method

With Impulsive Excitation, all you need to carry is Type 2250-F/2270-F, a tripod and a balloon (or other impulsive source, such as a starting pistol). After you start the analyzer and pop the balloon, the analyzer will start measuring, analyse the decay and display the RT spectrum and decay.

The single input range means that trial measurements are not necessary when using the impulsive excitation method.

Fig. 14.4 *Typical RT measurement cycle for the impulsive excitation method*

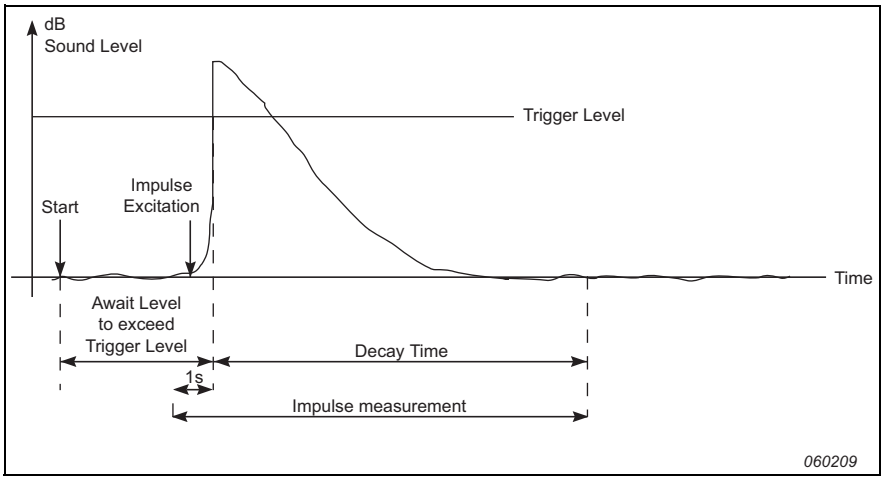


Fig. 14.4 shows a typical RT measurement cycle performed by the analyzer, where the different steps are described as follows:

1) After ‘Start’, the analyzer waits for the level to exceed the ‘Trigger Level’ (indicated on the analyzer in three places by the “traffic light” giving a short green flash every second).

2) The impulse excitation is made, for example, a pistol is fired or a balloon is burst.

   CAUTION: The use of hearing protection is highly recommended.

3) The impulse measurement is started 1 s before the level exceeds the ‘Trigger Level’.

4) The impulse measurement stops after the analyzer detects the background noise level again (automatically measured by the analyzer).

5) The analyzer performs backward integration of the impulse measurement.

6) The reverberation time spectra EDT, T20 and T30 are calculated and displayed on the screen.

The measurement can be in octaves or 1/3-octaves in parallel over a selectable frequency range. In each frequency band, the decay is sampled 200 times each second.

The impulse response is backward integrated (according to the Schroeder method). In theory, the resulting decay will be equivalent to the average of a large number of decays made with the interrupted noise method. Therefore, the decays will be smooth using just one single shot.

14.2 Setting up the Analyzer

1) Select the **Reverberation Time** project template. (see section 3.3.1 for more details on templates.) The project template is displayed at the top of the screen, if it does not display **Reverberation Time**, tap the black bar at the top of the screen and select *Reverberation Time* from the drop-down menu that appears.

2) Tap the **Main Menu** icon and select *Setup* from the list of options. Set the *Bandwidth* and *Bottom* and *Top Frequency* of the measurement as required.

3) Set *Map Based Measurement = No* in the **Measurement Control** setup – the reverberation decays will then be numbered from Pos. 1 to N. See how to measure with position management in section 14.2.1.

4) Set *Automatic Save = No*, if you want to inspect the reverberation time and decays before manually saving the measurement – otherwise select *Yes* to automatically save the decays after each measurement.

5) Set *Measurement Mode* to:
   - *Parallel*, for measuring all bands in a spectrum simultaneously
   - *Serial*, for measuring selected bands only (to be saved and merged with a previously measured Parallel spectrum)
   - *Combined*, for measuring Parallel and then Serial in an automated sequence

   When doing the Serial measurement, the bandwidth of the generator will match the selected band, thus increasing the output power for the band and increasing the signal to noise ratio for the band.

6) The analyzer automatically detects the decay time and stops the measurement at the end of the decay – however, under special conditions (for example, when measuring with high background noise) the decay time cannot be detected and the measurement will run up to 20 s. To minimise the measurement time and memory requirement for the measurement, you can limit the measurement by setting the *Max Decay Time*. 3 s is adequate for most ordinary rooms, but should be increased for larger halls or reverberation rooms.

7) Set *Excitation to Impulse* if you want to measure using the impulse method (go to step 15) – otherwise select *Interrupted Noise*.

14.2.1 Interrupted Noise Method

8) Set the number of decays you want to measure per position – the analyzer automatically controls the generator, measurement of the decays and averaging the decays.

9) Set the *Generator* as required – set *Generator Type = External* if you want to control an external generator (details in Appendix A) – otherwise leave it at *Internal* to use the internal generator.

10) Select *Noise Type* for the internal generator. *Pink* noise is typically used.

11) Adjust the level of the internal generator output to match the input of the power amplifier used by setting *Level [re. 1 V]*.
Note: You can manually turn the generator on and off by tapping on the **Loudspeaker** icon in the Status Field.

12) Set the *Escape Time* allowing you to leave the room before the generator is turned on during the measurement – see Fig. 14.3.

13) Set *Build-up Time* to allow the excitation noise to reach a steady level before the measurement starts. 1 s is adequate in most ordinary rooms, but should be increased for larger halls or reverberation rooms.

14) Select the *Sound Source* used, to optimise the frequency response of the internal generator output for either a flat power response or optimum power difference between adjacent 1/1- or 1/3-octave bands – thereby eliminating the need for an equalizer to smooth the response in most cases. Select a type matching your sound source – select *Unknown* if you are using a non Brüel & Kjær sound source, or do not want to make a correction to the frequency response. Go to step 16.

14.2.2 Impulsive Method

15) Set *Trigger Level* low enough to be sure the impulse will be triggered, but high enough to avoid triggering on the background noise. A level between 80 and 100 dB is normally adequate.

16) If you have selected *Automatic Save = Yes*, then *Trigger Repeat* can be set to *Yes* to automatically start a new measurement when a measurement has been saved. This allows you to go to another position and make a new impulse, without the need for controlling the analyzer between the measurements. Observe how the "traffic light" indicates the status of the measurement (see Table 4.2 and Fig. 14.4) making it easy for you to change position and generate the impulse synchronised with the measurement procedure. Press the **Start**/**Pause** pushbutton to stop the measurement when the last measurement has been saved.

14.2.3 Signal Recording

17) Set *Recording Control = Automatic* if you want to record the signal during the measurement. The recordings can be played back afterwards for identifying the cause of measurements differing from each other – or (if *Excitation = Impulse*) for further analysis of the measured

impulse response by post-processing software like DIRAC Room Acoustics Software Type 7841.

The recordings will contain the signal from when you press the **Start** pushbutton until the measurement stops. The recording will be attached to the measurement as an annotation.

Note: Signal Recording requires a license for Signal Recording Option BZ-7226.

To exit the Setup screen, tap the icon.

14.2.4 Controlling the Measurement

The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start**/**Pause**, **Continue**, **Reset** and **Save** pushbuttons, see Chapter 3 for more details.

Note the following exceptions:

- Pressing **Start** initiates a measurement cycle slightly more complex than a standard SLM measurement – see Fig. 14.3 and Fig. 14.4 for details. The results are the same, however, a set of measurement data – in this case the reverberation decays at one position
- Creating a new reverberation time project: The measured data is stored at a position – and you can have several positions in one project. Therefore, starting a complete new project cannot be done by pressing **Reset** and then **Start** (as when measuring using the SLM template), because this will measure the decays at a single position within the Project – a new project is initiated by selecting a new project template (or the same again). This will create a new project

14.2.5 Serial Measurements

If you have made a measurement using the Interrupted Noise method and at some frequencies you have not been able to get a sufficient signal to noise ratio. This problem may show up at frequencies where the background noise has been too high. The frequencies will then be marked with red smileys (see Table 14.1).

To solve this, you either have to lower the background noise (which might not be possible) or increase the power of the loudspeaker in the source room.

If your loudspeaker already produces as much noise as possible, you can limit the frequency range of the noise to cover just a single frequency band while keeping the output power constant, thus increasing the noise level in the smaller frequency range. For a 1/3-octave band, this will increase the noise level at the band by up to 10 dB.

To select the frequency bands to be measured (using noise limited to cover these bands only):

1) Select *Measurement Control* from the Setup screen.
2) Set the *Measurement Mode* to *Serial*.
3) On the Spectrum display, select the bands you want to measure using the cursor and tap on the x-axis to select the band for serial measurement (Fig. 14.5).

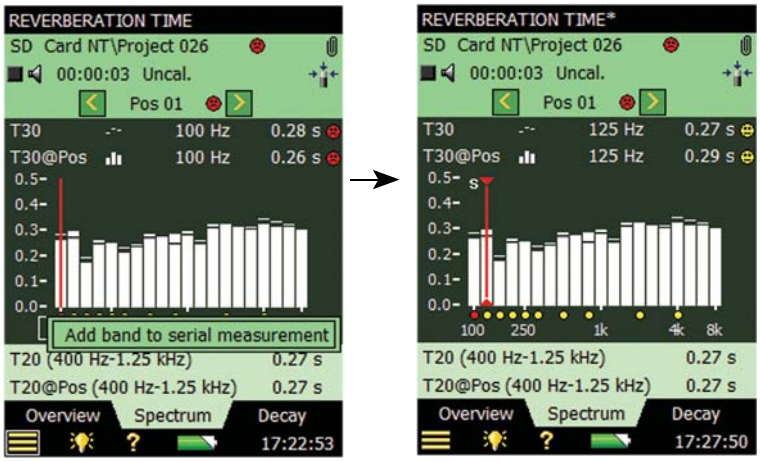


Fig. 14.5
Selecting the bands for serial measurements
Left: *Selecting the band for serial measurement*
Right: *The arrow is pointing to the "s" symbol, which indicates the selected frequency band*

Note: A small *s* appears above the selected frequency bands (Fig. 14.5).

4) When you have selected the frequency bands you want to re-measure, press the **Start/Pause** pushbutton.

The analyzer will then start at the lowest selected frequency band, generate noise at this band, make the measurement and automatically step to the next selected band. This will continue until all selected bands have been measured.

5) Press the **Save** pushbutton to save and merge the bands with the measurement you have already done (be sure to select the right position before saving).

Combine Parallel and Serial Measurements in an Automated Sequence

You can speed up the measurement process if you start by investigating whether you need to use serial measurements at certain frequency bands, or not. If you need to measure some bands serially, then you can select *Measurement Control* from the Setup screen, and set the Measurement Mode to *Combined*. Then select the bands you want to measure serially (see above).

Press the **Start/Pause** pushbutton to make a normal parallel measurement and then do the serial measurements – all in an automated sequence.

14.2.6 Annotating Projects and Positions

While using the Reverberation Time Software you can annotate the Reverberation Time project using the normal method of adding annotations to a project. The annotations can then be viewed by tapping on the **Annotations** icon or tapping the **Main Menu** icon and selecting *Explorer* from the list of options. See section 3.5.

However, your project can contain a lot of measurements, one per position, so you can annotate any position in the project. Signal recordings are automatically attached as annotations to the positions. Annotations at positions are managed in the **Overview** display – described in the next section.

14.3 Displaying the Results

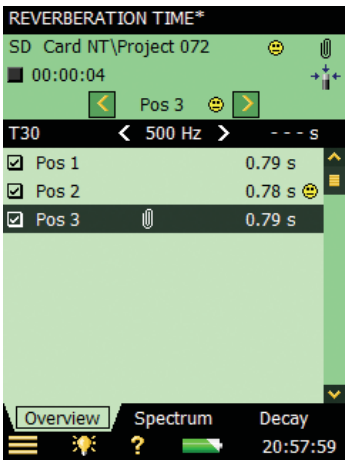
The Reverberation Time Measurement screen includes three tabs at the bottom: **Overview**, **Spectrum** and **Decay**. The tabs allow you to choose different ways of displaying the measurement results:

- **Overview**: Shows the measurement positions in a table – one position per row. Use this to get an overview of your measurements, to include/exclude positions from the spatial average of all positions in the room, and to manage annotations/signal recordings at the positions
- **Spectrum**: Shows the reverberation spectra graphically, or as a table, for one position, or for the room average. Alternatively, it can show the instantaneous sound pressure level while measuring
- **Decay**: Shows the reverberation decay at a single frequency, for one position, or for the room average

14.3.1 Overview

The **Overview** tab shows the measurement positions in a table – one position per row.

Fig. 14.6
Overview tab



Status Field

The Status Field consists of three lines (see Fig. 14.6) – the first two lines of information are common to the status lines in the Sound Level Meter and Frequency Analyzer (see Chapter 4).

Note: The first line of the Status Field might also contain a smiley, indicating the quality of the room (the spatial average of all positions). See the description of smileys in the following paragraph and section 14.5.

The third line of information allows you to:

- Select the measured position. The selected position is the one highlighted in the table. The selected position will be the one displayed when selecting the **Spectrum** or **Decay** view
- Step forwards or backwards through the positions on all displays, using the and icons
- Get information on the quality of the measurement through a quality indicator (smiley) displayed as an icon:

  : means results should be used with caution

  : means results may be suspect or missing

  No icon means the analyzer found no measurement quality issues

Tap the smiley to get more detailed information about the quality indication. (See the description of smileys in section 14.5.)

Table

The header row of the table contains (from left to right):

- The RT selector (EDT, T20 or T30), which determines which RT to display in the table rows below. It is also linked to the main *Spectrum* selector and main *Decay* selector
- The Frequency selector (which includes decrement and increment buttons), determines the frequency of the readouts in the table rows below. The frequency selector is linked to the *Spectrum* cursor and the frequency of the selected *Decay*
- Readout of the RT value for the current measurement, before it is saved to a position

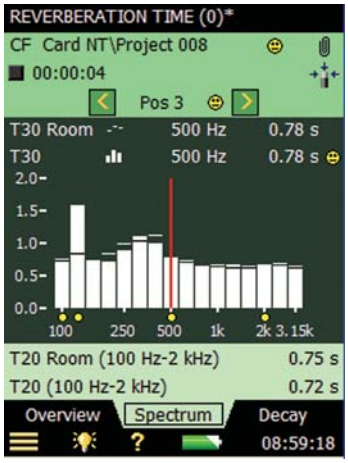
Each row of the table contains (from left to right):

- A checkmark controlling whether the position is included or excluded from the Room Average. Tap it to include (check) or exclude (uncheck) the position. All positions are by default included in the Room Average
- The position. Tap it to get a drop-down with two options, *Select* and *View Annotations*. Use *Select* to select the position and *View Annotations* to view the list of annotations for the position. You can add annotations on the position from this view – as described in Chapter 6
- Possible annotation indicated by . Tap it to view the list of annotations for the position
- The readout of the RT parameter at the frequency determined by the RT selector and Frequency selector in the table header row. There might be a smiley to the right of the readout warning about the quality of the readout. Tap the smiley to get more detailed information about the warning

14.3.2 Spectrum

The **Spectrum** tab shows the reverberation time spectrum from a position, or the room average reverberation time, or both. The sound level is displayed during measurements.

Fig.14.7
Spectrum tab



Status Field

The Status Field on the **Spectrum** tab is the same as on the **Overview** tab.

Spectrum Graph

The Spectrum graph is the same as in the Frequency Analysis software: Two 1/1-octave, or 1/3-octave spectra, superimposed with cursor readouts. The displayed frequency range is automatically adjusted for the measured frequency range.

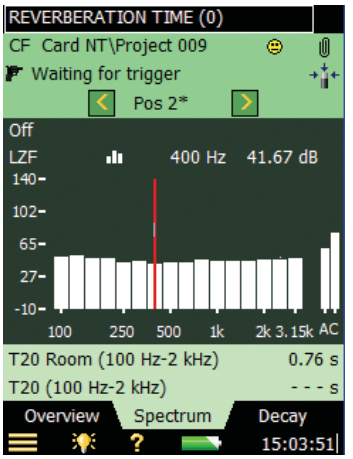
Small smileys are set below each frequency band with a potential problem. The smileys are also available at the cursor readouts. Tap the smiley at the cursor readout to get detailed information about the warning.

The Spectrum Parameter selectors above the graph selects which spectra to display. You can choose to display: *T20*@Pos, *T30*@Pos, *EDT*@Pos, *T20*, *T30* or *EDT*. If you only want one graph you can set the other to *Off*.

In addition to choosing which parameter to display, you can choose to *Display Sound Level* – this will display the Z-weighted spectrum LZF together with the A- and C-weighted broadband levels – see Fig.14.8. When displaying LZF you can tap the LZF selector and select *Display Reverberation Time* to display the reverberation time spectra.

When starting a measurement the graph will automatically display the sound level spectrum, when finished it will display the reverberation time spectrum.

Fig. 14.8
Spectrum view when measuring



The Main Spectrum graph on the display (the one with bars) is selected using the parameter selector on the second line of the two shown above the graph (LZF in Fig. 14.8). The smileys below the spectra (if there are any) belong to the Main Spectrum. The parameter selector for the Main Spectrum is linked to the selector on the **Overview** tab and the parameter selector for the main decay on the **Decay** tab.

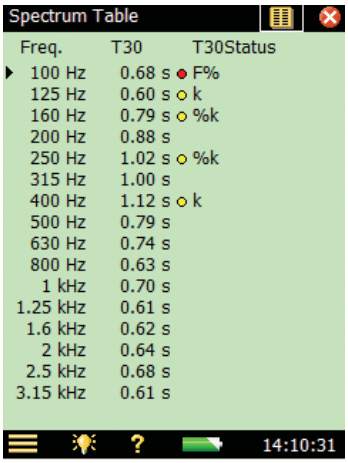
The reference spectrum on the display (the one displayed as small lines above the bars in Fig. 14.7) is selected using the parameter selector on the first line of the two shown above the graph (*T30* in Fig. 14.7). The parameter selector for the reference spectrum is linked to the parameter selector for the reference decay curve in the **Decay** view.

The cursor is linked to the Frequency selectors on the **Overview** and **Decay** tabs.

Tap the Y-axis to select:

- *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum
- *Zoom In/Zoom Out* to adjust the zoom
- *Spectrum Table* to display the spectrum in a table, see an example in Fig. 14.9

Fig. 14.9
Spectrum table



Auxiliary Parameters

Below the graphics are two lines containing parameters for displaying the wide band reverberation times for the current position, or the room average. You are also able to display the L_{CF} and L_{AF} broadband values.

14.3.3 Decay

The **Decay** tab shows the reverberation time decay from a position or the room average – or both (Fig. 14.10).

Status Field

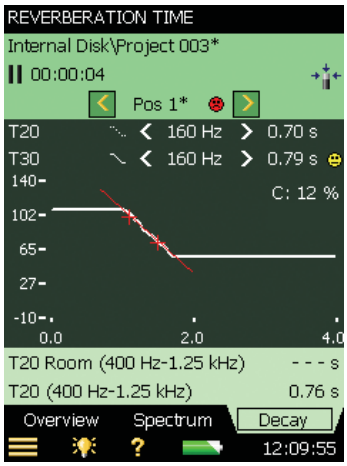
The Status Field on the **Decay** tab is the same as on the **Overview** and **Spectrum** tabs.

Decay Graph

The Decay graph shows the decay of one frequency band for the selected position and/or the decay of the same frequency band for the room average (requires *Ensemble Averaging*).

The Decay Parameter selectors above the graph select which decay to display: *T20*@Pos, *T30*@Pos or *EDT@Pos*. Each of these selections show the decay for the measurement at the selected position together with the readout of T20@Pos, T30@Pos and EDT@Pos resp. *T20*, *T30* and *EDT* show the decay for the Room Average together with the readout of T20, T30 and EDT resp. If you only want one graph you can set the other selector to *Off*.

Fig.14.10
Decay view



The main decay on the display (displayed as a continuous line) is selected using the parameter selector in the second line of the two shown above the display (*T30*@Pos in Fig.14.10). The parameter selector for the main decay is linked to the selector on the **Overview** tab and the parameter selector for the main spectrum on the **Spectrum** tab.

The reference decay on the display (displayed as a dashed line) is selected using the parameter selector in the first line of the two shown above the display (*T20*@Pos in Fig.14.10). The parameter selector for the reference decay is linked to the parameter selector for the reference spectrum on the **Spectrum** tab.

The Frequency selector (with decrement and increment buttons as well), determines the frequency of the decay curves. The Frequency selector is linked to the spectrum cursor and the Frequency selector on the **Overview** tab.

In the upper right corner of the View Area, the value of a single quality indicator is displayed:

- C: xx%. The Curvature indicator – if above 10%, then the quality indicator '%', meaning 'Decay is bent', is set

For more details of the quality indicators, see section 14.5.

Tap the Y-axis to select:

- *Auto Zoom* to adjust the range of the Y-axis for best fit of the measured spectrum
- *Zoom In/Zoom Out* to adjust the zoom
- *Auto Scale* to select the best scaling for viewing the spectra – without adjusting the zoom
- *Scale Up/Scale Down* to adjust the full scale value on the Y-axis
- *Show/Hide Regression Line* to show/hide the regression line and the evaluation range for the main decay, together with the two quality indicators C and ξ

14.4 Measurements with Graphical Position Management

The analyzer can keep track of the source and receiver positions in a graphical way together with the measurements. To do this, make the following settings on the Setup screen:

1) Set *Map Based Measurement = Yes* in the *Measurement Control* setup – the reverberation decays will then be placed graphically on the 'map' shown on the **Overview** tab, and numbered as source-receiver relations (for example, S1R2 means the decay measurement with noise from Source 1 and measured at Receiver position 2).

2) Set *Meas. All Pos. for Each Source = Yes* for measuring all combinations of source and receiver positions. Set to *No*, if you want to measure at a specific number of receiver positions per source.

3) Set *No. of Positions per Source* to the number of receiver positions you want to measure per source.

4) Set *Increment* to *Sources First*, *Receivers First* or *Manual*. Typically *Sources First* is best for Impulsive excitation (you can then walk between the source positions and generate the impulses while the analyzer is placed on a tripod at one receiver position); *Receivers First* is best for Interrupted Noise excitation (you can move the analyzer between the receiver positions, while the sound source remains in the same place).

The **Overview** tab will then look like Fig. 14.11:

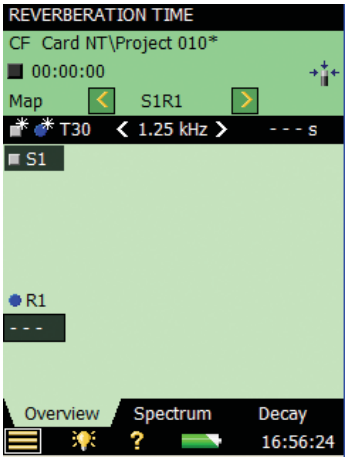


Fig. 14.11
Overview tab showing one source and one receiver position

Note the **Add Source** and **Add Receiver** icons on the headline for the map. Tap to add new sources, and tap to add new receivers on the map.

Fig. 14.12
Overview tab showing two sources and three receiver positions

You can move the sources or receivers on the map by tapping on the source/receiver (see Fig. 14.13), select *Move* from the drop-down menu that appears, then tap at the position where you want the source/receiver (see Fig. 14.14).

Fig. 14.13
Tap a source to get a drop-down with options

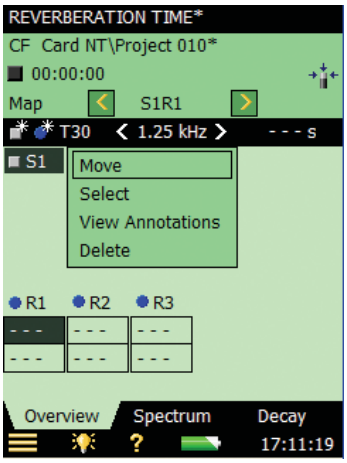
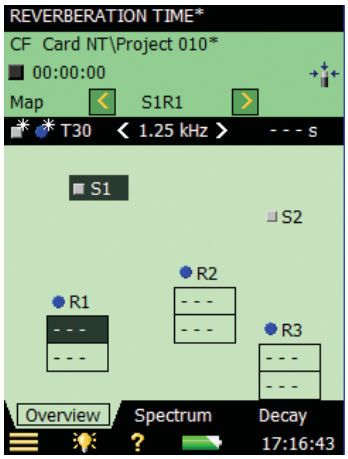


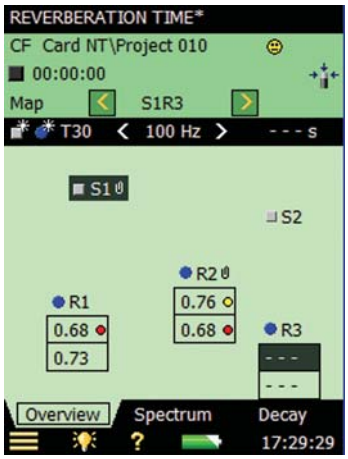
Fig.14.14
Sources and receivers moved to places on the map in accordance with their physical position in a room



The dark-green fields on the map indicate the selected Source-Receiver relation. The next measurement will be saved at this position.

Results from the measurements at the receiver positions are displayed in the boxes at the receiver positions – determined by the parameter and frequency selector in the headline of the map.

Fig.14.15
Example display showing a measurement in progress

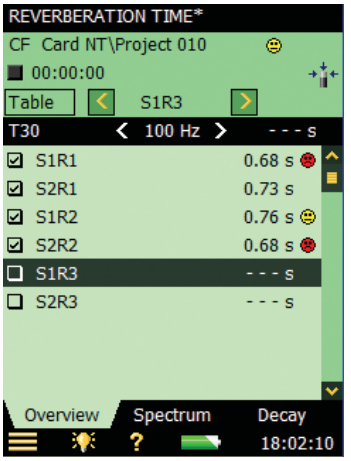


The example in Fig.14.15 shows the state when four measurements have been made and saved and the position at S1R3 is selected, ready for the next measurement. Note the small smileys at some of the receiver positions – you can tap them and get more detailed information.

You can attach text or commentaries at source or receiver positions by selecting *View Annotations* (Fig.14.13) and add new annotations as described in Chapter 6. Note the two small paperclips at S1 and R2 – they indicate annotations at these positions.

Tap *Map* just above the **Add Source** and **Add Receiver** icons, and select *Table* to display the measurements in a table (see Fig. 14.16). The table contains the same information as the table described in the previous section when measuring without position management (Fig. 14.6).

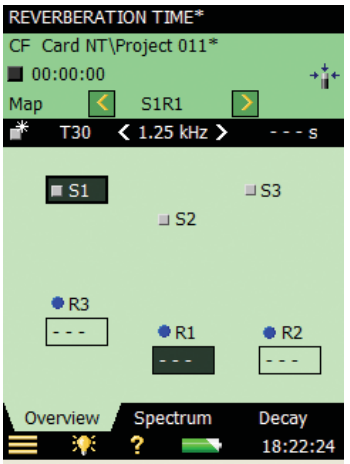
Fig. 14.16
Map-based measurements displayed in a table



Note: You can move the data from one position to another: Tap a position you want to move and select *Cut* from the drop-down, then tap the position where you want to paste it and select *Paste*. This can be done on the map as well as in the table.

If you want to measure at a specific number of receiver positions per source, then the map for one receiver position per source, for example, will look like Fig. 14.17.

Fig. 14.17
Map-based measurement showing one receiver per source



Note: There is only an **Add Source** icon because the specified number of receivers is added automatically when adding a source.

The **Spectrum** and **Decay** views function in the same way as when measuring without position managing. The only difference is the indication of the position in the Status Field – this is now a Source-Receiver selector instead of a Position Number selector.

14.5 Quality Indicators

There are quality indicators for each frequency band in each reverberation time spectrum for each reverberation time spectrum. These include letters, symbols or smileys, see Table 14.1 for an overview. One of the quality indicators are recommended in ISO 3382-2 Annex B, as a measure of how good the slope of the decay can be approximated to a straight line:

- C: xx%. The Curvature indicator – if above 10%, then the quality indicator '%', meaning 'Decay is bent', is set

Table 14.1 *Overview of Quality Indicators and Smileys*

Quality Indicator	Smiley	Explanation	Description
N		No decay end found	The end of the decay cannot be determined because it doesn't end in the background noise
y		Background noise too high	Background noise is above the upper evaluation point
t		No decay start found	No decay start found
Y		Background noise too high	Background noise is above the lower evaluation point
T		Max. Decay Time too short	The lower evaluation point is beyond the decay time
Z		No decay found	The slope of the decay is positive, that is, the reverberation time is negative
P		Reverberation time too short	Less than 2 points in Evaluation Range
O		Excitation sound level too high	Overload
F		Reverberation time too short	B×T below 16 (B = filter bandwidth and T = reverberation time of detector) – required by ISO 3382
R		T20 used (T30 unavailable)	T20 used (T30 unavailable)
n		High background noise	Background noise too close to level at lower evaluation point
p		Short reverberation time	Less than 4 points in Evaluation Range
%		Decay is bent	The difference between T20 and T30 is greater than 10%. (Recommended quality indicator from ISO 3382-2 Annex B)
k		Decay is non-linear	Correlation coefficient in linear regression is too low

The quality indicators (first column) are shown in the spectrum table only.

The smileys are shown on:

- all readouts of reverberation time results
- on the Position selector as the 'sum' of all quality indicators from each frequency band
- on the Room (project) as the 'sum' of all quality indicators from each frequency band in the Room reverberation time spectrum

The explanation is shown if you tap a smiley (except on the small smileys below the frequency bands in the spectrum – select the frequency band with the cursor and tap the smiley in the cursor readout).

14.6 Saving and Recalling Results

Measurements are saved at position numbers (for example, *Pos. 1*) or Source-Receiver relations (for example, *S1R1*) within the project. This means there are more measurements stored in the Reverberation Time projects than the Sound Level Meter, Frequency Analyzer or Logging projects, which all contain only one measurement within each project.

The saved project can be opened using *Open* in **Explorer**, then you can view all the measured data, and even continue measuring at new positions.

Chapter 15

Tone Assessment Option BZ-7231 – 1/3-octave Method

15.1 General

Tone Assessment Option BZ-7231 includes tone assessment according to selected methods. The software module includes an ‘FFT based’ as well as a ‘1/3-octave based’ method. It allows assessment of tones on-site.

The result of the tone assessment is the adjustment to be added to the L_{Aeq} as described in the relevant standards for calculating rating level.

BZ-7231, when used with Frequency Analysis Software BZ-7223, Logging Software BZ-7224, and Enhanced Logging Software BZ-7225, allows you to:

- Assess tones in a measured 1/3-octave spectrum according to ISO 1996:2007, Annex D
- Assess tones in a measured 1/3-octave spectrum according to Italian Law, “Ministero dell’ambiente, Decreto 16 marzo 1998”, hereafter referred to as “Italian Law”

BZ-7231, when used with FFT Analysis Software BZ-7230, allows you to:

- Assess tones in a measured FFT spectrum according to ISO 1996:2007, Annex C
- Use the “Generate tone at cursor” feature to generate a pure tone on the headphone output of the Hand-held Analyzer, for comparison to the actual noise

This section will focus on tone assessment based on the 1/3-octave method. Please refer to User Manual BE 1778: “FFT Analysis Software BZ-7230 and Tone Assessment Option BZ-7231, for use with Hand-held Analyzers Types 2270 and 2250” for detailed information about tone assessment based on FFT spectra.

Tone Assessment Option BZ-7231 brings results to the user on-site as well as preparing for post-processing and reporting back at the office. Documentation can be completed using Measurement Partner Suite BZ-5503, or the measured data can be exported for post-processing by Evaluator Type 7820 or other post-processing software such as Microsoft® Excel®.

Check the *About* screen to see whether you have a license to run the Tone Assessment option. (To access the *About* screen, tap the **Help** icon ? then tap *About*.)

If you have purchased Type 2250/2270 together with the software application(s), then the relevant license(s) comes pre-installed on the analyzer.

If you purchased a separate software application for your Type 2250/2270, then you have to install the license on the analyzer. This is done using BZ-5503, please consult the on-line help included with the BZ-5503 software for instructions on how to install a license.

15.2 Tone Assessment According to ISO 1996-2, Annex D

When assessing noise, it is generally recognised that noise containing audible pure tones is more annoying than noise with the same A-weighted broadband level that does not contain audible tones. When assessing noise that contains tones or narrow bands of noise, an adjustment shall be added to the A-weighted time averaged level, L_{Aeq}. The first evaluation of audible tones in noise is most often carried out by the human ear. But for comparative analysis results, and documentation, an objective analysis may be needed.

Tone Assessment can be performed using the ISO 1996-2:2007 standard “Determination of environmental noise levels”, Annex D: “Objective method for assessing the audibility of tones in noise – Simplified method”. This method uses 1/3-octave measurements.

The selection of method depends on local legislation which may refer to ISO 1996-2 or a local method.

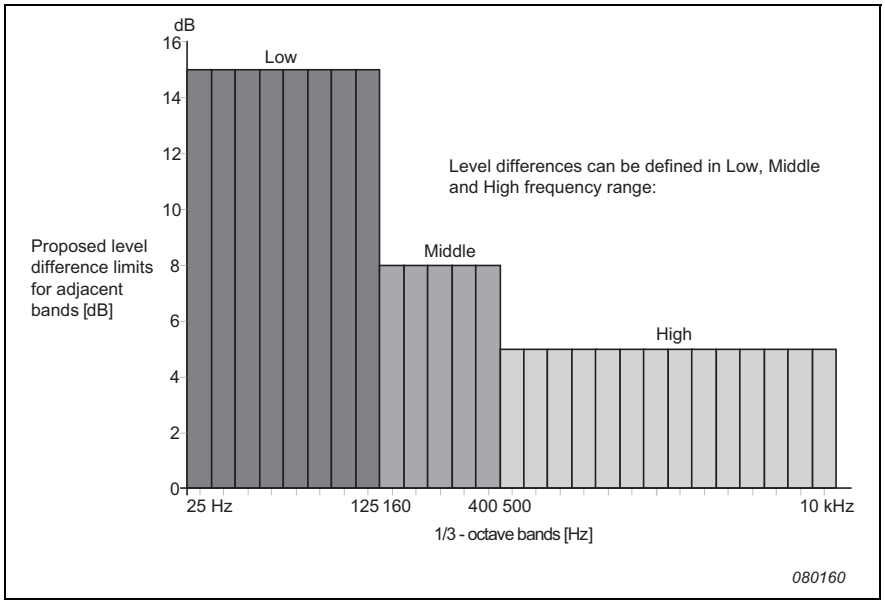
Find more information about rating level and assessment of environmental noise in ISO 1996-2 and in Brüel & Kjær’s Environmental Booklet.

15.2.1 ISO 1996-2, Annex D – Tone Assessment Calculations

The ISO method searches a measured, time averaged (L_{eq}) spectrum, for level differences between adjacent 1/3-octave bands. If the level difference between a 1/3-octave band and the band either side of it are higher than a certain limit, an adjustment for audible tones may be added to the L_{Aeq} level when calculating the rating level, L_r.

In ISO 1996-2, Annex D, the spectrum is divided into three frequency ranges: Low, Middle and High. In each frequency range a specific limit for the level differences leading to an adjustment is defined (Fig. 15.1).

Fig.15.1 *Definition of frequency ranges and level differences*



The proposed frequency ranges and level differences between adjacent bands are:

- **Low frequency range:** includes the 1/3-octave bands from 25 Hz to 125 Hz with a level difference for a detected tone greater than 15 dB
- **Middle frequency range:** includes the 1/3-octave bands from 160 Hz to 400 Hz with a level difference for a detected tone greater than 8 dB
- **High frequency range:** includes the 1/3-octave bands from 500 Hz to 10 kHz with a level difference for a detected tone greater than 5 dB

With BZ-7231 software, frequency ranges and the limit for the level differences in low, middle and high range can be set by the user.

Tone assessment is carried out for all the measured frequency bands (including those below 25 Hz and above 10 kHz). The level difference limit is extrapolated from the low and high range to cover the complete measurement range.

If tones are detected outside the range from 25 Hz to 10 kHz the quality indicator (yellow smiley) indicates “Tone out of ISO range detected”.

ISO 1996-2, Annex D does not specify the size of the adjustment. In the default setting of the BZ-7231, Brüel & Kjær has chosen to set the value to 5 dB.

Calculating the Level Difference Between One Band and the Adjacent Bands

BZ-7231 software calculates the level difference between a 1/3-octave band and two adjacent 1/3-octave bands with lower levels. The difference is calculated between the band in the middle and the highest of the adjacent bands.

15.3 Tone Assessment According to Italian Law

Tone Assessment in Italy is performed on normal 1/3-octave spectra but with an option to use narrow bands (such as FFT), in case of doubt.

The method described in the Italian "Decreto 16 marzo 1998" states that the 1/3-octave L_{ZFmin} spectrum is used for evaluation of tones in noise. The analysis must be performed in the frequency range from 20 Hz to 20 kHz and a tone is present if the level of a band is more than 5 dB higher than the levels in the adjacent bands. The adjustment K_t, which should be added to the measured L_{Aeq}, will only be applied if the band with the tone touches or exceeds a loudness level contour touched by another frequency value of the spectrum. (Examples of loudness level contours from Evaluator Type 7820 are shown in Fig.15.2.) The size of the adjustment K_t is defined as 3 dB.

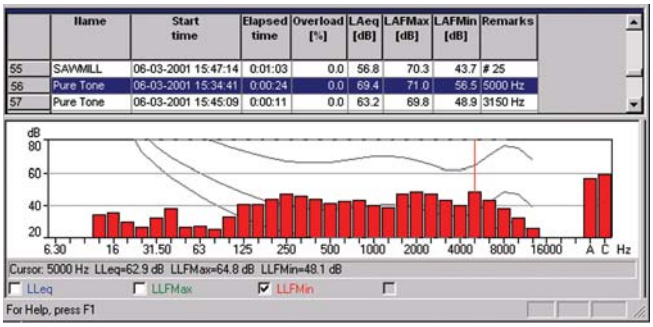


Fig.15.2
Example display from Evaluator Type 7820 showing an L_{LFmin} spectrum and loudness level contours

An equal loudness curve is a frequency response curve. Equal loudness curves are the experimental results of presenting pure tones and levels at different frequencies to young people with no hearing impairment. Along a contour line the young, average, normal listener will judge tones presented with different combinations of frequency and dB to be equally loud.

Equal loudness level curves are defined by ISO 226 "Acoustics – Normal equal-loudness-level contours". The Italian "Decreto 16 marzo 1998" refers to ISO 226 (1987), but the ISO 226 standard has been thoroughly revised in the latest version from 2003. Your analyzer, with BZ-7231 software installed, uses by default the free-field curves from the 1987 version. But the diffuse-field contours from the ISO 226 (1987), as well as the free-field curves from ISO 226(2003) have been implemented and may be selected.

15.4 Setting up the Analyzer

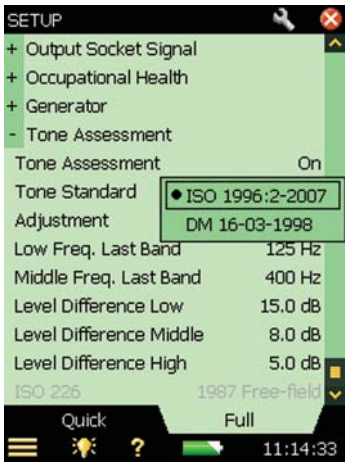
15.4.1 Selecting the Tone Assessment Option

Tap the **Main Menu** icon and select *Setup* from the list of options. Under the *Tone Assessment* parameters (on the full list of options) tap the *Tone Assessment* option and set it to *On* (Fig. 15.3).

Fig. 15.3
Setting Tone Assessment option on

From the Setup screen, select either the *ISO 1996:2-2007* or the Italian Law *DM 16-03-1998* method:

Fig. 15.4
Setting the Tone Assessment method



If you select the tone assessment method according to the ISO 1996-2, Annex D standard, you can accept the default setup according to that standard. You can then change the various tone parameters according to your needs (apart from the *ISO 226* parameter which is greyed-out) and proceed directly to the measurement.

If you select the tone assessment method according to Italian Law (that is, you select *DM 16-03-1998)*, then you have accepted the default setup for that standard, and the only parameter you can change is the *ISO 226* parameter. Select one of the diffuse- or free-field contour options available from the parameter drop-down (which appears when you tap the parameter). For more details and for information on how to set up individual tone assessment parameters, see the following section.

15.4.2 Setting up a Measurement Manually

ISO 1996–2, Annex D

When tone assessment according to ISO 1996-2, Annex D is selected, you can set the division between the Low and Middle frequency range, the division between the Middle and High frequency range, and also the limits for the level differences between adjacent bands – see Fig. 15.5. (You can also refer to Fig. 15.1 for a definition of the frequency ranges and level differences.)

Fig. 15.5
Left: *Setting the 'Low Freq. Last Band' parameter*
Right: *Setting the 'Level Difference Low' parameter*

You set the division between the Low/Middle frequency range by selecting the required value for the *Last* (or highest) *Band* in the Low frequency range (from 12.5 Hz to 315 Hz), and set the division between the Middle/High frequency range by selecting the required value for the *Last* (or highest) *Band* in the Middle frequency range (from 160 Hz to 20 kHz).

The ISO method does not state which frequency weighting should be used, so in the default setup, A-weighing is selected. However, this is not described in the ISO method, so no warnings will be generated if you select other frequency weightings.

Italian Law

When tone assessment according to Italian Law is selected, the analyzed spectrum must be the Z-weighted minimum level measured in each 1/3-octave band, L_{ZFmin}. The L_{ZFmin} parameter is automatically selected on the measurement page when you select *DM 16-03-1998*.

The test for loudness contours is set by default to the *1987 Free-field* option of the *ISO 226* contour parameters. You can also select the *1987 Diffuse-field* and *2003 Free-field* options from the ISO 226 contour parameters, if required. See Fig. 15.6.

Fig. 15.6
Setting the loudness contour options

15.4.3 Setting up the Measurement using the Default Setup

Select the *Tone* parameter above the spectrum and start the measurement by pressing the **Start/Pause** pushbutton. If the selected setup parameters do not comply with the selected tone assessment method, the following pop-up window will be displayed:

Fig. 15.7
Pop-up window for tone measurement setup check

The pop-up window can be de-activated for the rest of the measurement session. To activate it again, you will have to reload the template or restart your analyzer. This automatic check is deactivated when the *Tone Assessment* parameter is set to *Off* in the Setup screen.

To reset all the relevant parameters to the default setup, tap the **OK** button. (The default setup includes preset parameters that comply with the selected standard. These are described in Table 15.1.) To measure with the settings you set up manually, tap the **Cancel** button.

Table 15.1
Default parameters used by the automatic measurement setup check

Setup Parameter	Default Value
Selected standard: ISO 1996-2, Annex D	
Adjustment	3 dB
Last band in low frequency range	125 Hz
Last band in middle frequency range	400 Hz
Level difference low	15 dB
Level difference middle	8 dB
Level difference high	5 dB
Selected standard: Italian Law (DM 16-03-1998)	
ISO 226	1987 Free-field

Note 1: Even if you have set the *Tone Assessment* parameter to *On* (Setup screen), the calculation is not carried out until the *Tone* parameter is selected above the spectrum.

Note 2: You may find the **Template Explorer** (accessed from the **Main Menu**) useful to save your own measurement setup.

15.4.4 Signal Recording

If a valid license for the Signal Recording Option BZ-7226 is present, it is possible to record the sound while measuring. (Refer to Chapter 13 for information about the Signal Recording Option.)

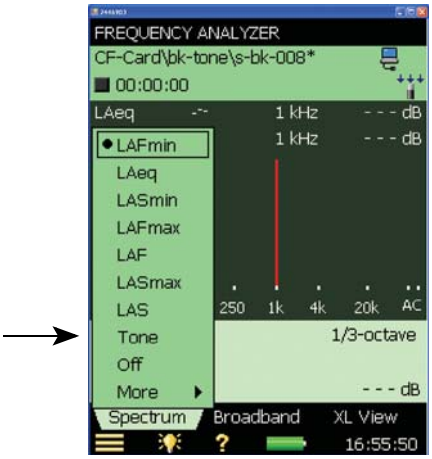
Note: When analyzer recordings are to be used for re-analysis on a PC, be sure to select *Automatic Gain Control* parameter to *Off*, under the *Signal Recording* parameters, and select the *Recording Quality* parameter to *High*.

15.5 Measuring

15.5.1 Result Display

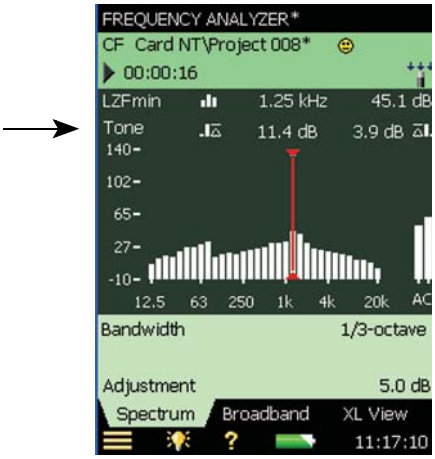
Tone assessment is not performed until the *Tone* parameter is selected above the spectrum. (This is done by tapping one of the parameter fields in the two lines above the Spectrum display and choosing *Tone* from the drop-down menu.) Once selected, tone assessment is carried out on the selected spectrum. The results are updated during the measurement.

Fig.15.8
Selecting the Tone parameter above the spectrum display



On the Results display, a blue marker is set at the top of each detected band with a tone. Differences to the left and right of the frequency band selected by the main cursor are shown (on the left and right) in the tone parameter panel above the spectrum (Fig.15.9). The main cursor is moved using either the hard keys or the stylus.

Fig.15.9
The differences to the left and right of the selected frequency band are shown in the tone parameter panel – in this example, there is a 11.4 dB difference to the left and a 3.9 dB difference to the right



The information shown in the value panel can be changed by tapping in the field. From the tone parameters, the adjustment and the selected tone standard can be selected. See Fig. 15.10.

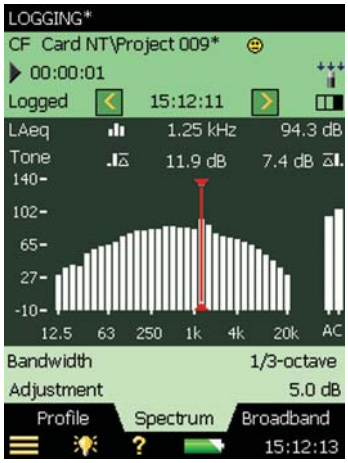
Results from the tone assessment can also be found by tapping on the **Broadband** tab and browsing the **Broadband** view in a similar way.

Fig. 15.10
Changing the information shown in the value panel

15.6 Logging Software BZ-7224 Template

The results from the tone assessment can be found in the **Spectrum** view of the Logging template. Tone assessment is performed for each logging period, as well as for the total measurement time (Fig. 15.11).

Fig. 15.11
Viewing results on the logging template

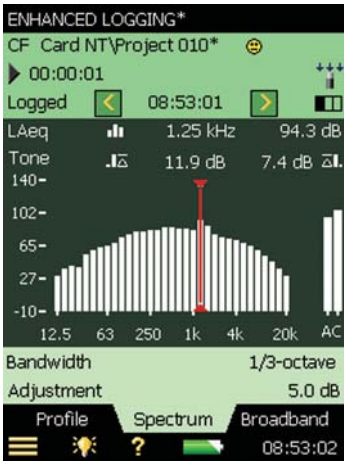


Please find more information about setting up a Logging measurement in Chapter 11.

15.7 Enhanced Logging Software BZ-7225 Template

The tone parameter can be shown, for both the logging and the report periods, in the **Spectrum** view of the Enhanced Logging template (Fig. 15.12).

Fig. 15.12
Viewing results on the enhanced logging template

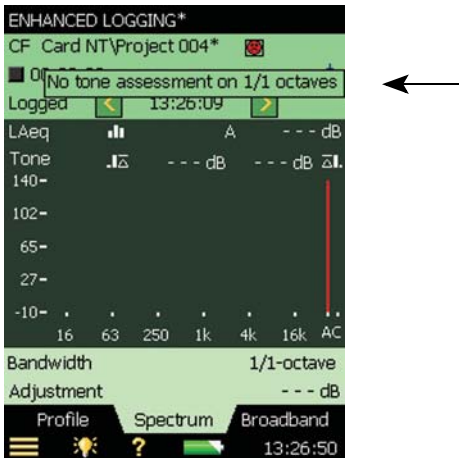


Please find more information about setting up the Enhanced Logging in Chapter 12.

15.8 Status Codes (Smileys)

When *Tone* is selected on the tone parameter panel, the list of status codes is updated. Tap a smiley to get an explanation of the status code, and for a tip on how to remedy or improve the settings on the analyzer, see an example in Fig. 15.13.

Fig. 15.13
Example of a status code explanation



If you have selected *1/1-octave*, an *Accelerometer* as transducer, or a *Direct* input, tone assessment will be performed, but a smiley will be displayed. When you tap the smiley it will advise you to use a *Microphone*.

For an overview of all the remedies associated to the various smileys, please refer to Table 15.2

Table 15.2 *Overview of smileys and associated remedies*

Smiley	Colour	Explanation	Remedy – Tip for Solution
	Red	No tone assessment on 1/1 octaves	There is no method for assessing tones when the spectrum is analysed in 1/1-octave bands, select 1/3-octave instead
	Red	Analysis on ‘Accelerometer’	The analysis is carried out on an accelerometer input, select a microphone
	Red	Spectrum must be L_{ZFmin}	When Italian Law is selected the analysed spectrum must be L_{ZFmin}
	Red	No tone assessment on inst. parameters	It is not possible to make tone assessments on instantaneous parameters (‘Fast’ or ‘Slow’)
	Yellow	Analysis on ‘Direct’	The analysis is carried out on a ‘Direct’ input, select a microphone
	Yellow	Setup different from ISO standard	The ISO is selected and the measurement setup deviates from the proposals in the ISO standard
	Yellow	Min or Max spectrum	When the ISO standard is selected the analyzed spectrum should be L_{eq}
	Yellow	Tone freq outside proposed ISO range	In the ISO standard the defined frequency range for tone assessment is from 25 Hz to 10 kHz. A tone is detected outside this frequency range
	Yellow	Tone freq out of proposed DM range	In the standard according to Italian Law the tone assessment must be performed in the range from 20 Hz to 20 kHz. A tone is detected outside this frequency range

Note: The ISO method does not specify the weighting filter to be used. The A-weighting filter is selected by default, but all selectable broadband filters may be applied without warnings.

15.9 Recalling Saved Measurements

Saved measurements using the **Frequency Analyzer**, **Logging** and **Enhanced Logging** templates can be opened and the Tone Assessment can be applied. Please refer to section 3.4 and section 6.3 for information on how to save and recall measurements, respectively.

Chapter 16

2-channel Option BZ-7229

16.1 General

2-channel Option BZ-7229 enables 2-channel measurements with Hand-held Analyzer Type 2270. This option adds an extra channel of measurement data. The two channels can have inputs from the same type of transducer (e.g., two microphones) or different transducers (e.g., one microphone and one accelerometer)

2-channel Option works with the following applications:

- Sound Level Meter BZ-7222
- Frequency Analysis BZ-7223
- Logging BZ-7224
- Enhanced Logging BZ-7225
- Building Acoustics Software BZ-7228

And with the options:

- Signal Recording Option BZ-7226
- Low Frequency Option BZ-7234

Note 1: 2-channel Enhanced Logging is not available for hardware versions 1 – 3.

Please refer to Building Acoustics Software BZ-7228 User Manual BE-1799 for a description of the Dual-channel Building Acoustics Software

Note 2: To check whether you have the license to run the relevant this software tap on the shortcut bar and select **About**.

Note 3: If you have purchased your analyzer together with the software application(s), then the relevant license(s) comes pre-installed on the analyzer.

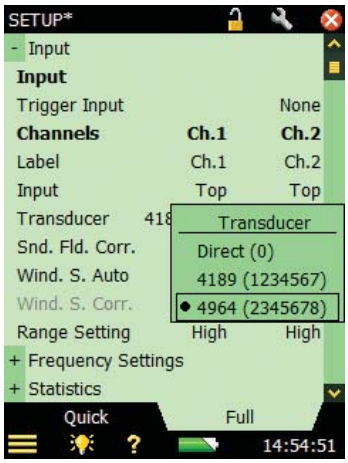
Note 4: If you purchased a separate software application for your analyzer, you have to install the license on the analyzer. This is done using BZ-5503, please consult the online help included with the BZ-5503 software for instructions on how to install a license.

16.2 Connecting Transducers

Please refer to section 2.5 for connecting two transducers to the instrument and to Chapter 5 for creating the transducers in the transducer database and for calibrating.

Tap **Main Menu** and select *Setup* > *Input* you will see two columns for the individual settings of the two channels. See Fig. 16.1 for how to setup the two transducers. In *Setup* you may also set up individual transducer correction filters like the windscreen correction.

Fig. 16.1
Set up the transducers



To choose labels other than Ch.1 and Ch.2 (e.g., *In* for *Ch.1* and *Out* for *Ch.2*), tap the *Label* parameter and enter the new label.

16.3 Range Setting

Note: Pressing before a measurement institutes Auto Range, which automatically selects *High Range* or *Low Range*, as appropriate.

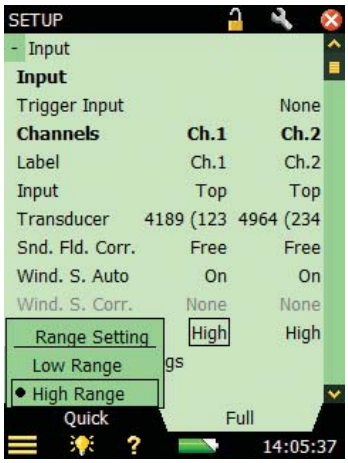
Type 2270 hardware can be utilised in two ways:

1) As a single-channel, single-range sound level meter and frequency analyzer like Type 2250:
   - Only one channel can be measured at a time
   - The input is selectable between the two physical channels in the user interface
   - The full level measuring range is covered in a single range without a level range control

2) As a dual-channel, multi-range sound level meter and frequency analyzer
   - Both channels can be measured simultaneously
   - The full level measuring range is covered in two ranges with a level range control. Theses ranges are called:
     a) High Range for the least sensitive range with 0 dB gain, which allows the highest possible input
     b) Low Range for the most sensitive range with 30 dB gain

To set the range settings for 2-channel measurements, tap **Main Menu** and select *Setup* > *Input* > *Range* and select the appropriate range (Fig.16.2).

Fig.16.2
Range setting



16.3.1 Underrange/Overload

In case of an Underrange indication in line 2 of the status panel (*High Range* only), change to *Low Range*. In case of Overload indication (typically *Low Range*), change to *High Range*. (Or use Autorange, which takes a few seconds.) The latched overload is indicated per channel using icons: For Ch.1 , for Ch.2: and for both channels: .

16.4 Setting Up 2-channel Sound Level Meter

1) Select the *2-Ch. Sound Level Meter* project template.

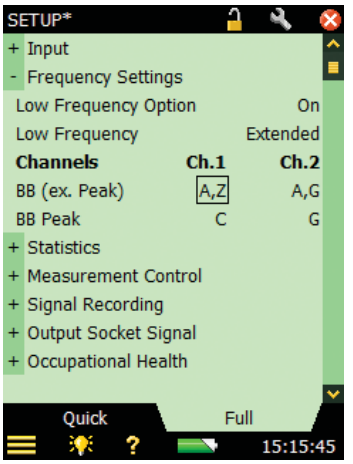
   The project template is displayed at the top of the screen, if it does not display the correct template tap the Project Template Bar at the top of the screen and select the correct template from the drop-down menu. (See section 3.3.1 for more details on templates.)

2) Tap the **Main Menu** icon .

3) Select (Fig. 16.3)
   - *Setup* > *Frequency Settings* to set Broadband frequency weighting parameters, as required
   - *Setup* > *Statistics* to set statistics parameters, as required

4) Tap to exit *Setup*.

Fig. 16.3
Setting the frequency and statistics parameters



16.4.1 Controlling the Measurement

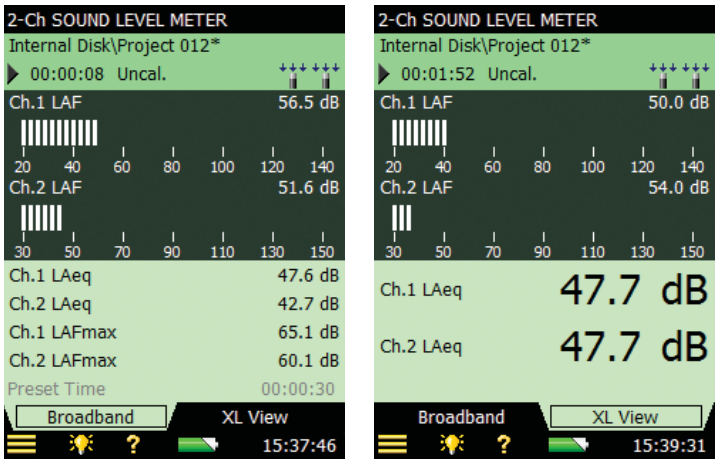
The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

The two channels are controlled and measured simultaneously, thus some of the housekeeping parameters are common for the two channels, e.g., *Start Time* and *Elapsed Time*.

16.4.2 Displaying the Results

The results are displayed as bar graphs and measurement parameters can be displayed in the **Broadband** or **XL View** (Extra Large) by selecting the appropriate tab (Fig. 16.4).

Fig.16.4
Displaying the results



16.4.3 Saving Results

Measurements are saved and can be opened later in the same way as described for the Sound Level Meter project in Chapter 3.

16.5 Setting Up 2-channel Frequency Analyzer

1) Select the *2-Ch. Frequency Analyzer* project template.

   The project template is displayed at the top of the screen, if it does not display the correct template tap the Project Template Bar at the top of the screen and select the correct template from the drop-down menu. (See section 3.3.1 for more details on templates.)

2) Tap the **Main Menu** icon .

3) Select (Fig.16.5)

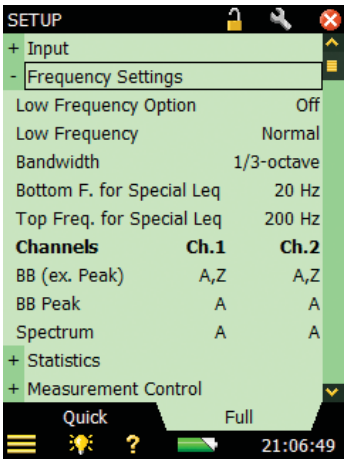
   – *Setup* > *Frequency Settings* to set Broadband frequency weighting parameters, as required

   – *Setup* > *Statistics* to set statistics parameters, as required

   The settings for Spectrum Weighting and base for Spectrum Statistics are available in this template.

4) Tap to exit *Setup*.

Fig.16.5
Setting the frequency and statistics parameters



16.5.1 Controlling the Measurement

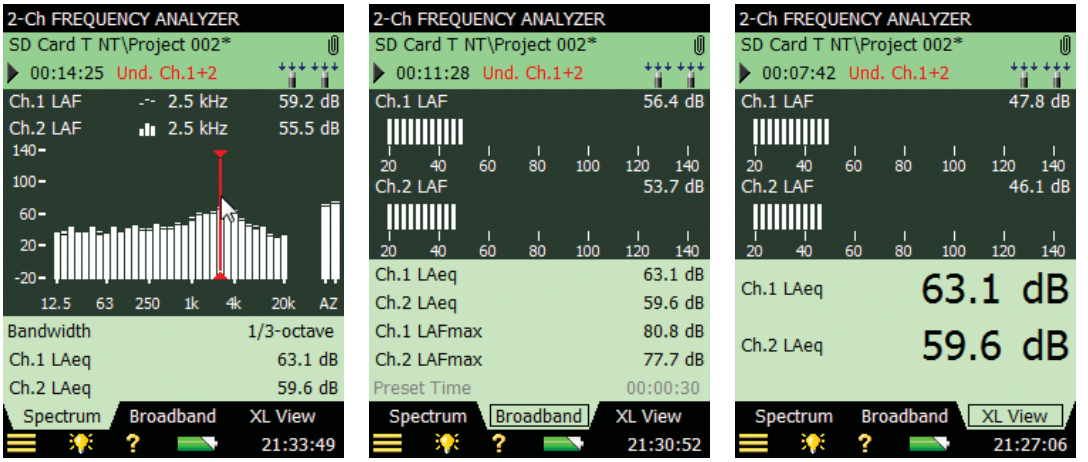
The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

The two channels are controlled and measured simultaneously, thus some of the housekeeping parameters are common for the two channels, e.g., *Start Time* and *Elapsed Time*.

16.5.2 Displaying the Results

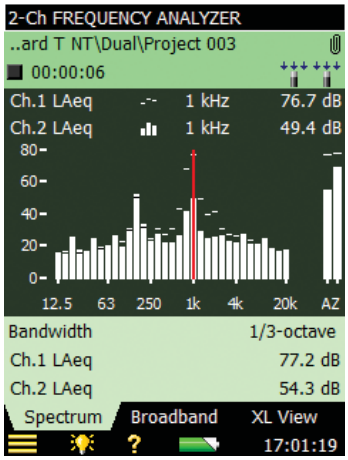
The results are displayed as bar graphs and measurement parameters on the Measurement screen in three views: **Spectrum**, **Broadband** or **XL View** (Extra Large), by selecting the appropriate tab (Fig.16.6).

Fig.16.6 *Displaying the results (Spectrum, Broadband and XL)*



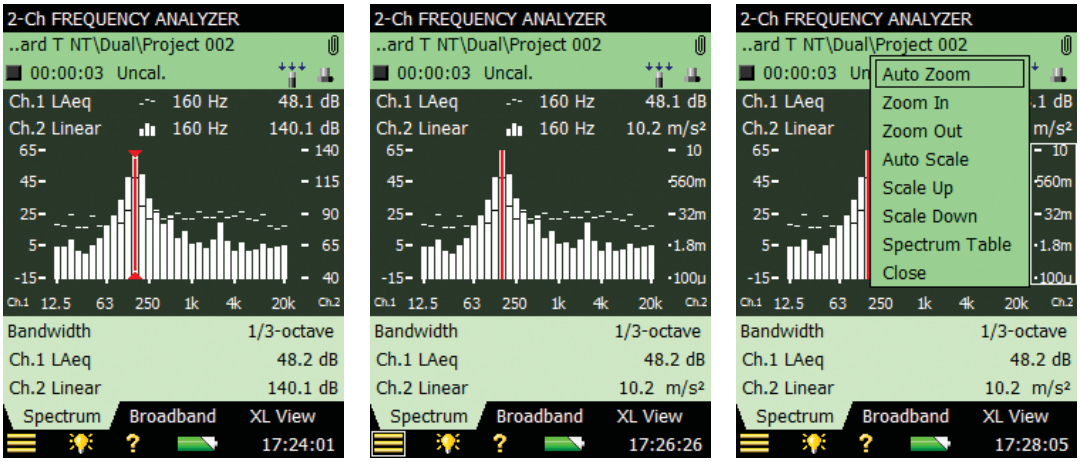
When the same type of transducers are used by both channels (e.g., two microphones or two accelerometers) or if you only display data from one channel, then the spectrum display is the standard spectrum display (Fig. 16.7).

Fig. 16.7
Single-channel spectrum



When the transducers at the two channels are of different types (e.g., a microphone and an accelerometer), the scaling of the two spectra can be set individually for easy comparison. Ch.1 will use the standard Y-axis at the left of the spectrum and Ch.2 will have its own Y-axis to the right of the spectrum (instead of the broadband values). Tapping on the Ch.2 Y-axis reveals the same possibilities for zooming and scaling the spectrum as for Ch.1. See examples in Fig. 16.8.

Fig. 16.8 *Displaying the results with different scaling for each channel*



16.5.3 Saving Results

Measurements are saved and can be opened later in the same way as described for the Sound Level Meter project in Chapter 3.

16.6 Setting Up 2-channel Logging and Enhanced Logging

1) Select:
   - The *2-Ch. Logging SLM* project template for logging broadband data only from the two inputs
   - The *2-Ch. Logging* project template for logging both spectra and broadband data from the two inputs
   - The *2-Ch. Enh. Logging* project template for logging both spectra and broadband data from the two inputs, making reports and periodically saving the data on the memory card.

     Note: *2-Ch. Enh. Logging* is not available for hardware versions 1–3.

   The project template is displayed at the top of the screen, if it does not display the correct template tap the Project Template Bar at the top of the screen and select the correct template from the drop-down menu. (See section 3.3.1 for more details on templates.)

2) Tap the **Main Menu** icon .

3) Select
   - *Setup* > *Frequency Settings* to set Broadband frequency weighting parameters, as required
   - *Setup* > *Statistics* to set statistics parameters, as required

4) Set the parameters you want to log every 100 ms in *Logged Broadband (100 ms)*.

   You can specify up to 4 parameters from the two channels.

5) Set the broadband parameters you want to log in *Logging Broadband*.

   You can either log all parameters from both channels or select up to 10 parameters from the two channels. The fewer parameters you select the less space will be needed for saving on the memory card.

6) Set the spectrum parameters you want to log in Logged Spectrum.

   You can either log all spectrum parameters from both channels or select up to four spectrum parameters from the two channels.

7) Set the Level Trigger parameter(s) as required.

   You can level trigger on a parameter from either Ch.1 or Ch.2.

8) Tap to exit *Setup*.

Note: You should select the transducers before selecting the parameters to log and selecting the level trigger parameter(s). Changing the transducer afterwards might correct the selected parameter; e.g., if you have selected to log Ch.1 LAeq and change the transducer at channel 1 from a microphone to an accelerometer, then the Ch.1 LAeq will not be available anymore and the parameter will be set to Off.

16.6.1 Controlling the Measurement

The measurement is controlled in the same way you would control a single-channel Logging or Enh. Logging measurement. See Chapter 11 and Chapter 12 for more details.

The two channels are controlled and measured simultaneously, thus some of the housekeeping parameters are common for the two channels, e.g., *Start Time* and *Elapsed Time*.

16.6.2 Displaying the Results

The results are displayed as bar graphs and measurement parameters on the Measurement screen in three views: **Profile**, **Spectrum** or **Broadband**, by selecting the appropriate tab.

See Chapter 11 for more details on Logging displays and Chapter 12 for more details on controlling Enhanced Logging displays.

16.6.3 Saving Results

Measurements are saved and can be opened later in the same way as described for Logging in Chapter 11 and Enhanced Logging in Chapter 12.

16.7 Setting Up 2-channel Signal Recording

Signal Recording in the 2-Ch. templates is set up in the same way as in the single channel templates (Chapter 13), with the following additions and changes:

1) The *Recording Channel* parameter can be set to *Ch.1*, *Ch.2* or *Both*.

   Choose *Both* to record both channels simultaneously.

2) The *Recorded Signal* parameter is set to *Input Z-weighted* and cannot be changed.

   The *Recorded Signal* parameter is not displayed in the setup.

3) If *Automatic Gain Control* set to *Off*, the *Peak Recording Level* is automatically set to highest possible setting, e.g., 145 dB for *Range Setting = High Range* and 115 dB for *Range Setting = Low Range* when using Type 4189 microphones.

   The Peak recording Level parameter is not displayed in the setup.

2-channel recordings are played back in the headphones as a stereo signal.

Use Measurement Partner Suite BZ-5503 to play back the 2-channel recordings either as a stereo signal or as two mono signals, one for Ch.1 and one for Ch.2.

Chapter 17

Low Frequency Option BZ-7234

Low Frequency Option BZ-7234 enables

- G-weighting parameters in accordance with the standards ISO 7196:1995 and ANSI S1.42–2001 (R2011) using Brüel & Kjær Low Frequency microphones
- Measurements of Building Vibration parameters using Brüel and Kjær Low Level accelerometer in accordance with the standards ISO 8041:2005 and DIN 45669-1:2010–09
- 1/3-octave frequency analysis down to 0.8 Hz (1/1-octave down to 1 Hz)

This option can be used together with the following modules:

- Sound Level Meter Software BZ-7222
- Frequency Analyzer Software BZ-7223
- Logging Software BZ-7224
- Enhanced Logging Software BZ-7225

Note 1: Check the *About* screen to see whether you have a license to run the Low Frequency Option. (To access the *About* screen, tap the **Help** icon ? then tap *About*.)

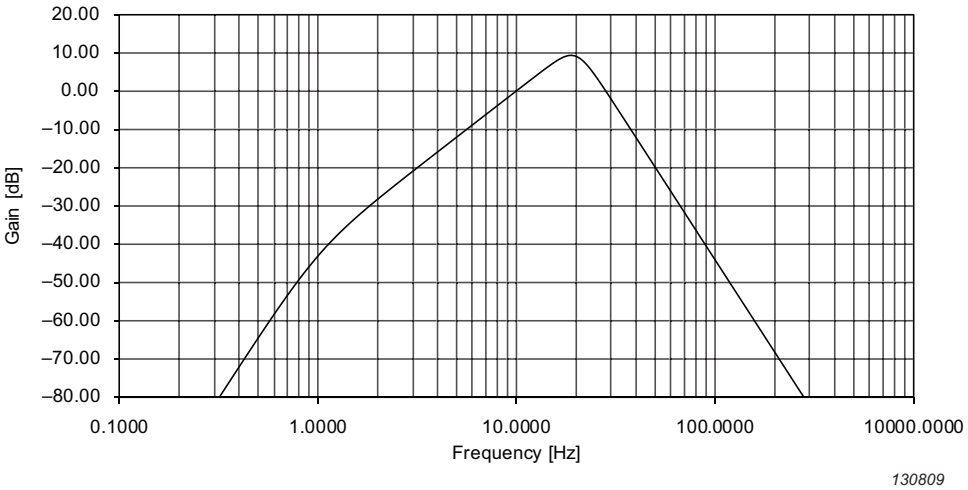
Note 2: If you have purchased your analyzer together with the software application(s), then the relevant license(s) comes pre-installed on the analyzer.

Note 3: If you purchased a separate software application for your analyzer, then you have to install the license on the analyzer. This is done using BZ-5503, please consult the online help included with the BZ-5503 software for instructions on how to install a license.

17.1 Sound Measurements and G-weighting

This section describes how to measure G-weighting parameters. See the G-weighted frequency response in Fig.17.1.

Fig. 17.1 *G-weighted frequency response*



Low Frequency Option BZ-7234, together with BZ-7222, BZ-7223, BZ-7224 or BZ-7225 and a low-frequency microphone, Type 4193 or Type 4964 (possibly with Low Frequency Adaptor UC-0211, refer to Table C.5, Note for Type 4193 and Type 4964) measures the following timed broadband parameters in addition to the standard measured parameters:

- *LGeq* – G-weighted equivalent continuous noise level
- *LG10max* – maximum time-weighted sound level measured with G-weighting and 10 s exponential time constant
- *LG10min* – minimum time-weighted sound level measured with G-weighting and 10 s exponential time constant
- *LGpeak* – maximum peak sound level with G-weighting
- *TGpeak* – time when the G-weighted peak sound level occurred

The following instantaneous values are also available:

- *LG10* – instantaneous time-weighted sound level with G-weighting and 10 s exponential time constant
- *LGpeak,1s* – maximum peak sound level with G-weighting during the latest second

17.2 Setting up the Analyzer for G-weighting

1) Mount your low-frequency microphone and low-frequency adaptor (if used) on the preamplifier and connect it to the top socket (see section 2.5.2). If it is your first time to use the microphone, it needs to be created in the transducer database (see section 5.8) and calibrated (see section 5.3).

2) Select the *Sound Level Meter*, *Frequency Analyzer*, *Logging*, *Logging SLM*, *Enh. Logging* or *Enh. Logging SLM* project template.

   The project template is displayed at the top of the screen, if it does not display the correct template tap the Project Template Bar at the top of the screen and select the correct template from the drop-down menu. (See section 3.3.1 for more details on templates.)

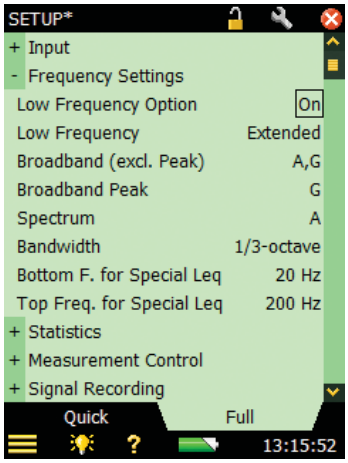
3) Tap the **Main Menu** icon and select *Setup*.

4) Select *Input* > *Transducer* and select appropriate microphone.

5) Select *Frequency Settings* > *Low Frequency Option* and select *On.*

   This will enable extra options for the *Low Frequency* parameter (Frequency Analyzer module only) and for the frequency weighting parameters (Fig. 17.2).

Fig. 17.2
Example of additional parameters with the Low Frequency Option *parameter set to* On



6) Set *Low Frequency* to *Extended*.

7) Set:
   - *Broadband (excl. Peak)* to *A,G* (simultaneous measurement with the two frequency weightings *A* and *G*)
   - *Broadband Peak* to *G* if you need to measure the G-weighted peak

8) (Frequency Analyzer module only) Set *Spectrum Weighting* parameter to *A*, *C*, *Z* or *G*, as required.

9) Tap to exit *Setup*.

17.2.1 Controlling the Measurement

The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

Note 1: The low-frequency settings require much longer settling times of filters and detectors for correct results. The instrument automatically takes care of this and waits (after you press **Start**) for the needed settling time for the individual detectors.

Note 2: You cannot start a measurement with G-weighting without using one of the low-frequency microphones.

17.2.2 Displaying the Results

Tap on the broadband result readouts to select parameters from the *Low Frequency* or the *Lpeak* group to select the G-weighted results (Fig.17.3).

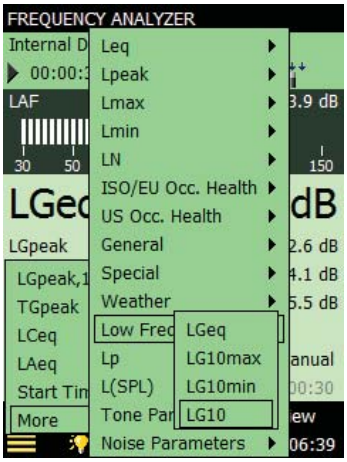


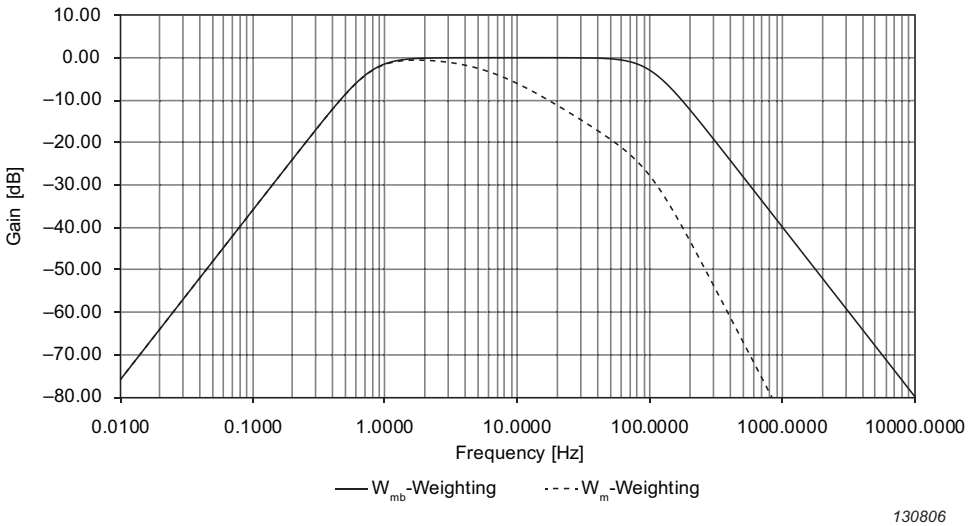
Fig.17.3
Selection of Low Frequency *broadband-readout results*

Note: If you use the Frequency Analyzer module, you will also have the parameter LXeq(f1-f2), X=A/B/C/Z/G and F1= bottom freq. and F2=top freq. of the frequency bands in the spectrum. By using G-weighting of the spectrum you would, for example, be able to readout the parameter LGeq(5 Hz-20 Hz) in cases where that needs to be reported.

17.3 Building Vibration Measurements

This section describes how to measure Building Vibration parameters. Building Vibration parameters are measured using Wm or Wmb filters (

Fig. 17.4 *Wm filters*



Low Frequency Option BZ-7234, together with BZ-7222, BZ-7223, BZ-7224 or BZ-7225 and Accelerometer Type 8344 for low-level measurements, measures the following timed broadband parameters in addition to the standard measured parameters:

- *aW* – time-averaged weighted* acceleration value
- *PeakW* – maximum peak of the weighted* acceleration value
- *aWCrest* – crest factor, given by $Peak_W/a_W$
- *MTVV* – maximum of the $a_{W,1s}$ values
- *KBFmax* – maximum of the KBF values
- *KBFTm* – average of the values of $KBFmax_i$, where each $KBFmax_i$ has been measured during 30 s

The following instantaneous values are also available:

- *aW,1s* – maximum time-weighted acceleration value during the latest second with weighting1) and 1 s exponential time constant
- *KBF* – instantaneous time-averaged acceleration level with W_m weighting and with 125 ms exponential time constant

  Note: W_m weighting of the acceleration signal corresponds to using H_{KB} weighting on the velocity signal, as defined in DIN 45669–1

*. Weightings can be either W_m (whole-body vibration in buildings, all directions) as defined in ISO 8041:2005 or W_{mb}, which is only the band-limiting part of the *Wm* filter. This is set by the *Broadband (Excl. Peak)* parameter.

17.4 Setting up the Analyzer for Building Vibration Measurements

1) Connect the accelerometer to the rear socket. Brüel & Kjær recommends Accelerometer Type 8344 for low-level building vibration measurements. If it is your first time to use the microphone, it needs to be created in the transducer database (see section 5.8) and calibrated (see section 5.3).

2) Select the *Sound Level Meter*, *Frequency Analyzer*, *Logging*, *Logging SLM*, *Enh. Logging* or *Enh. Logging SLM* project template.

   The project template is displayed at the top of the screen, if it does not display the correct template tap the Project Template Bar at the top of the screen and select the correct template from the drop-down menu. (See section 3.3.1 for more details on templates.)

3) Tap the **Main Menu** icon and select *Setup*.

4) Select *Input* > *Transducer* and select appropriate accelerometer.

5) Select *Frequency Settings* > *Low Frequency Option* and select *On.*

   This will enable extra options for the *Low Frequency* parameter (Frequency Analyzer module only) and for the frequency weighting parameters (Fig.17.5).

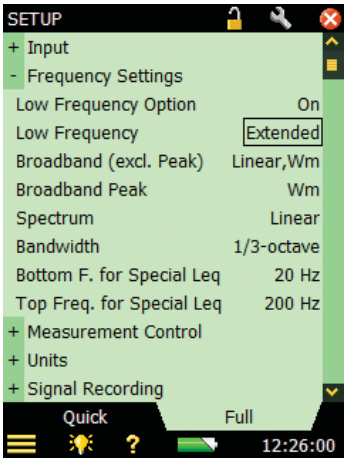


Fig.17.5
Example of additional parameters with the Low Frequency Option *parameter set to* On

6) Set *Low Frequency* to *Extended*.

7) Set *Broadband (excl. Peak)* to *Linear,Wm* (simultaneous measurement with the two frequency weightings *Linear* and *Wm*).

8) Set *Broadband Peak* to *Wm*.

9) Set *Spectrum Weighting* parameter to *Linear* or *Wm*, as required.

10) Select *Units* > *Engineering Unit* and select *No* (in dB) or *Yes* (in m/s^2).

Note: If you want readouts in g instead of m/s^2, set the *Vibration Unit* to *US/UK* in *Preferences* > *Regional Settings*.

11) Tap to exit *Setup*.

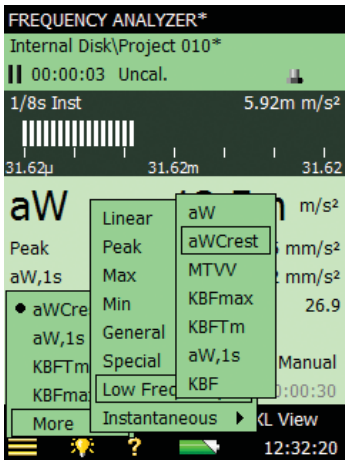
17.4.1 Controlling the Measurement

The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

17.4.2 Displaying the Results

Tap on the broadband result readouts to select parameters from the *Low Frequency* group to select the building vibration results (Fig.17.6).

Fig.17.6
Selection of Low Frequency *building vibration results*



17.5 Setting Up the Frequency Analyzer Module for Very Low Frequencies

1) For:
   - Sound measurements: Mount your low-frequency microphone and low-frequency adaptor on the preamplifier and connect it to the top socket (see section 2.5.2). If it is your first time to use the microphone, it needs to be created in the transducer database (see section 5.8) and calibrated (see section 5.3)
   - Vibration measurements: Connect the accelerometer to the rear socket. Brüel & Kjær recommends Accelerometer Type 8344 for low-level building vibration measurements. If it is your first time to use the microphone, it needs to be created in the transducer database (see section 5.8) and calibrated (see section 5.3)

2) Select the *2-Ch. Frequency Analyzer*, *Logging* or *Enh. Logging* project template.

   The project template is displayed at the top of the screen, if it does not display the correct template tap the Project Template Bar at the top of the screen and select the correct template from the drop-down menu. (See section 3.3.1 for more details on templates.)

3) Tap the **Main Menu** icon and select *Setup*.

4) Select *Input* > *Transducer* and select appropriate microphone or accelerometer.

5) Select *Frequency Settings* > *Low Frequency Option* and select *On.*

   This will enable extra options for the *Low Frequency* parameter (Frequency Analyzer module only) and for the frequency weighting parameters (Fig.17.2).

6) Set *Low Frequency* to *Very Low.*

   Note: Setting the *Low Frequency* parameter to *Very Low* for sound measurements requires use of the low-frequency microphones, possibly together with Low Frequency Adaptor UC-0211. These combinations ensure that the measurements fulfil the 1/1-octave and 1/3-octave filter standards; however, please consult section Table C.5 to see how the combinations influence the dynamic range of your measurement.

7) Set *Broadband (excl. Peak)*, *Broadband Peak* and *Spectrum Weighting* parameters, as required.

8) Tap to exit *Setup*.

17.5.1 Controlling the Measurement

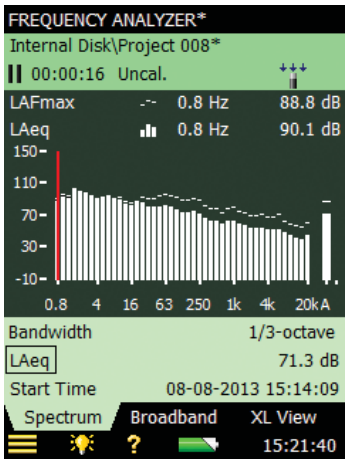
The measurement is controlled in the same way you would control a normal Sound Level Meter measurement, using **Start/Pause**, **Continue**, **Back-erase** and **Reset** pushbuttons, see Chapter 3 for more details.

Note: The low-frequency settings require much longer settling times of filters and detectors for correct results. The instrument automatically takes care of this and waits (after you press **Start**) for the needed settling time for the individual detectors.

17.5.2 Displaying the Results

The display frequency axis resolution may be adjusted by tapping the axis and selecting suitable display frequency limits (Fig.17.7).

Fig.17.7
Spectrum view with Low Frequency *set to* Very Low



17.5.3 Saving Results

Measurements are saved and can be opened later in the same way as described for the Sound Level Meter project in Chapter 3.

Chapter 18

Specifications

This chapter comprises the specifications that are needed for evaluation of analyzer performance characteristics and proper use of the analyzer. Some of the applicable sound level meter standards require additional technical documentation, in particular for pattern evaluation (type approval) purposes, but have no bearing on normal use. The additional technical documentation is given in a separate Brüel & Kjær instruction manual (BE 1712).

Specifications – Hand-held Analyzer Type 2250/2270 Platform

Specifications apply to Type 2250/2270 fitted with Microphone Type 4189 and Microphone Preamplifier ZC-0032

Microphone

SUPPLIED MICROPHONE
Type 4189: Prepolarized Free-field ½″ Microphone
or
Type 4190: Free-field ½″ Microphone
Nominal Open-circuit Sensitivity: 50 mV/Pa (corresponding to −26 dB re 1 V/Pa) ± 1.5 dB
Capacitance: 14 pF (at 250 Hz)

MICROPHONE PREAMPLIFIER ZC-0032
Nominal Preamplifier Attenuation: 0.25 dB
Connector: 10-pin LEMO
Extension Cables: Up to 100 m in length between the microphone preamplifier and Type 2250/2270, without degradation of the specifications
Accessory Detection: Windscreen UA-1650 can be automatically detected when fitted over ZC-0032

MICROPHONE POLARIZATION VOLTAGE
Selectable between 0 V and 200 V

SELF-GENERATED NOISE LEVEL
Typical values at 23°C for nominal microphone open-circuit sensitivity:

Weighting	Microphone	Electrical	Total
"A"	14.6 dB	12.4 dB	16.6 dB
"B"	13.4 dB	11.5 dB	15.6 dB
"C"	13.5 dB	12.9 dB	16.2 dB
"Z" 5 Hz–20 kHz	15.3 dB	18.3 dB	20.1 dB
"Z" 3 Hz–20 kHz	15.3 dB	25.5 dB	25.9 dB

Interface

KEYBOARD
Pushbuttons: 11 keys with backlight, optimised for measurement control and screen navigation

ON-OFF BUTTON
Function: Press 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

STATUS INDICATORS
LEDs: Red, amber and green

DISPLAY
Type: Transflective back-lit colour touch screen 240 × 320 dot matrix
Colour Schemes: Five different – optimised for different usage scenarios (day, night, etc.)
Backlight: Adjustable level and on-time

USER INTERFACE
Measurement Control: Using pushbuttons on keyboard
Setup and Display of Results: Using stylus on touch screen or pushbuttons on keyboard
Lock: Keyboard and touch screen can be locked and unlocked

USB INTERFACE
Hardware Versions 1 to 3: USB 1.1 OTG Mini B socket
Hardware Version 4: USB 2.0 OTG Micro AB and USB 2.0 Standard A sockets

MODEM INTERFACE
Connection to Internet through GPRS/EDGE/HSPA modem connected through:
- the Compact Flash slot (hardware versions 1 – 3)
- the USB Standard A Socket (hardware version 4)

Supports DynDNS for automatic update of IP address of host name

PRINTER INTERFACE
PCL printers, Mobile Pro Spectrum thermal printer or Seiko DPU S245/S445 thermal printers can be connected to USB socket

MICROPHONE FOR COMMENTARY
Microphone, which utilises Automatic Gain Control (AGC), is incorporated in underside of analyzer. Used to create voice annotations for attaching to measurements

CAMERA (TYPE 2270 ONLY)
Camera with fixed focus and automatic exposure is incorporated in underside of analyzer.
Used to create image annotations for attaching to measurements
Image Size:
- Hardware versions 1 – 3: 640 x 480 pixels
- Hardware version 4: 2048 x 1536 pixels

Viewfinder Size: 212 x 160 pixels
Format: jpg with exif information

Inputs/Outputs

COMPACT FLASH SOCKET (Hardware Version 1 to 3 only)
Connection of CF memory card, CF modem, CF to serial interface, CF Ethernet interface or CF WLAN interface

SECURE DIGITAL SOCKET
- 1 × SD socket for hardware versions 1 – 3
- 2 × SD sockets for hardware version 4

Connect SD and SDHC memory cards

LAN INTERFACE SOCKET Hardware Versions 1 to 3 (Type 2270 only):
- Connector: RJ45 MDI
- Speed: 10 Mbps
- Protocol: TCP/IP

Hardware Version 4 (Types 2250 and 2270):
- Connector: RJ45 Auto-MDIX
- Speed: 100 Mbps
- Protocol: TCP/IP

INPUT SOCKET (2 - TYPE 2270 ONLY)
Connector: Triaxial LEMO
Input Impedance: ≥ 1 MΩ
Direct Input: Max. input voltage: ± 14.14 V_{peak}
CCLD Input: Max. input voltage: ± 7.07 V_{peak}
CCLD Current/voltage: 4 mA/25 V

TRIGGER SOCKET
Connector: Triaxial LEMO
Max. Input Voltage: ± 20 V_{peak}
Input Impedance: > 47 kΩ
Precision: ± 0.1 V

OUTPUT SOCKET
Connector: Triaxial LEMO
Max. Peak Output Level: ± 4.46 V
Output Impedance: 50 Ω

HEADPHONE SOCKET
Connector: 3.5 mm Minijack stereo socket
Max. Peak Output Level: ± 1.4 V
Output Impedance: 32 Ω in each channel

Power

EXTERNAL DC POWER SUPPLY REQUIREMENTS
Used to charge the battery pack in the analyzer
Voltage: 8 – 24 V DC, ripple voltage < 20 mV
Current Requirement: min. 1.5 A
Power Consumption: < 2.5 W, without battery charging, < 10 W when charging
Cable Connector: LEMO Type FFA.00, positive at centre pin

EXTERNAL AC MAIN SUPPLY ADAPTOR
Part No.: ZG-0426
Supply Voltage: 100 – 120/200 – 240 VAC; 47 – 63 Hz
Connector: 2-pin IEC 320

BATTERY PACK
Part No.: QB-0061 Rechargeable Li-Ion battery
Voltage: 3.7 V
Capacity: 5200 mAh nominal
Typical Operating Time:
- Single-channel: >11 h (screen backlight dimmed); >8.5 h (full screen backlight)
- Dual-channel: >7.5 h (full screen backlight)

Use of external interfaces (LAN, USB, WLAN) will decrease battery operating time. Connecting a weather station or a GPS receiver can decrease battery operating with up to 20%
Battery Cycle Life: > 500 complete charge/discharge cycles
Battery Aging: Approximately 20% loss in capacity per year
Battery Indicator: Remaining battery capacity and expected working time may be read out in % and in time
Battery Fuel Gauge: The battery is equipped with a built-in fuel gauge, which continuously measures and stores the actual battery capacity in the battery unit
Charge Time: In analyzer, typically 10 hours from empty at ambient temperatures below 30°C. To protect the battery, charging will be terminated completely at ambient temperatures above 40°C. At 30 to 40°C charging time will be prolonged. With External Charger ZG-0444 (optional accessory), typically 5 hours
Note: It is not recommended to charge the battery at temperatures below 0°C (32°F) or over 50°C (122°F). Doing this will reduce battery lifetime

CLOCK
Back-up battery powered clock. Drift < 0.45 s per 24 hr period

Storage

INTERNAL FLASH-RAM (NON-VOLATILE)
For user setups and measurement data:
- Hardware versions 1 – 3: 20 MB
- Hardware version 4:512 MB

EXTERNAL SECURE DIGITAL MEMORY CARD
SD and SDHC Card: For store/recall of measurement data

EXTERNAL COMPACT FLASH MEMORY CARD (Hardware Versions 1 – 3 Only)
CF Card: For store/recall of measurement data

USB MEMORY STICK (Hardware version 4 only)
For store/recall of measurement data

Environmental

WARM-UP TIME
From Power Off: < 2 min
From Standby: < 10 s for prepolarized microphones

WEIGHT AND DIMENSIONS
650 g (23 oz.) including rechargeable battery
300 × 93 × 50 mm (11.8 × 3.7 × 1.9″) including preamplifier and microphone

User Interface

USERS
Multi-user concept with login. Users can have their own settings with jobs and projects totally independent of other users

PREFERENCES
Date, Time and Number formats can be specified per user

LANGUAGE
User Interface in Catalan, Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

HELP
Concise context-sensitive help in Chinese (People's Republic of China), English, French, German, Italian, Japanese, Korean, Polish, Portuguese, Romanian, Serbian, Slovenian and Spanish

UPDATE OF SOFTWARE
Update to any version using BZ-5503 through USB or update via Internet

REMOTE ACCESS
Connect to the analyzer using Measurement Partner Suite BZ-5503, using the 2250/2270 SDK (Software Development kit) or using an Internet browser supporting JavaScript. The connection is password protected
Two levels of protection:
- Guest level: for viewing only
- Administrator level: for viewing and full control of the analyzer

Software Specifications – Sound Level Meter Software BZ-7222

Conforms with the following National and International Standards:
- IEC 61672–1 (2013) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993–02) and Amendment 2 (2000–10), Type 1
- IEC 60804 (2000–10), Type 1
- DIN 45657 (1997–07)
- ANSI S1.4–1983 plus ANSI S1.4A–1985 Amendment, Type 1
- ANSI S1.43–1997, Type 1

Note: The International IEC Standards are adopted as European standards by CENELEC. When this happens, the letters IEC are replaced with EN and the number is retained. Type 2250/2270 also conforms to these EN Standards

Input

CHANNELS (Type 2270 only)
All measurements are made from either Ch.1 or Ch.2

TRANSDUCERS
Transducers are described in a transducer database with information on Serial Number, Nominal Sensitivity, Polarization Voltage, Free-field Type, CCLD required, Capacitance and additional information.

The analogue hardware is set up automatically in accordance with the selected transducer

CORRECTION FILTERS
For Microphone Types 4189, 4190, 4191, 4193, 4193 + UC-0211, 4950, 4952, 4952+EH-2152, 4955-A, 4964, 4964 + UC-0211 and 4184-A, BZ-7222 is able to correct the frequency response to compensate for sound field and accessories:
Sound Field: Free field or diffuse field (for Types 4952 and 4184-A only: 0° (Top) reference direction and 90° (Side) reference direction)
Accessories:
- Types 4189, 4190, 4964 and 4964 + UC-0211 only: None, Windscreen UA-1650 or Outdoor Microphone Kit UA-1404
- Types 4191, 4193, 4193 + UC-0211 and 4955-A only: None or Windscreen UA-1650
- Type 4950 only: None or Windscreen UA-0237

For Accelerometer Types 4397-A, 4513, 4513-001, 4513-002, 4514, 4514-001, 4514-002, 4533-B, 4533-B-001, 4533-B-002, 4534-B, 4534-B-001, 4534-B-002, 8324, 8341, 8344, 8347-C + 2647-D the lower frequency limit will be optimized to match the specifications for the accelerometer

Analysis

DETECTORS
Parallel detectors on every measurement:
A- or B-weighted (switchable): Broadband detector channel with three exponential time weightings (Fast, Slow, Impulse), one linearly averaging detector and one peak detector
C- or Z-weighted (switchable): As for A- or B-weighted
Overload Detector: Monitors the overload outputs of all the frequency weighted channels

MEASUREMENTS FOR SOUND INPUT
X = frequency weightings A or B
Y = frequency weightings C or Z
V = frequency weightings A, B, C or Z
U = time weightings F or S
Q = exchange rate 4, 5 or 6 dB
N = number between 0.1 and 99.9
For Storage Full statistics

For Display and Storage:

Start Time	Stop Time	Overload %
Elapsed Time	L_{Xeq}	L_{Yeq}
L_{XE}	L_{YE}	L_{Ceq}–L_{Aeqk}
L_{XSmax}	L_{XFmax}	L_{XImax}
L_{YSmax}	L_{YFmax}	L_{YImax}
L_{XSmin}	L_{XFmin}	L_{XImin}
L_{YSmin}	L_{YFmin}	L_{YImin}
L_{XIeq}	L_{YIeq}	L_{AIeq}–L_{Aeq}
L_{AFTeq}	L_{AFTeq}–L_{Aeq}	Time Remaining
$L_{ep,d}$	$L_{ep,dv}$	E
Dose	Proj. Dose	L_{vpeak}
#VPeaks (>NNNdB)	#VPeaks (>137dB)	#VPeaks (>135dB)
T_{Vpeak}	L_{avUQ}	TWA
TWAv	DoseUQ	Proj. DoseUQ
$L_{Aeq,T1,mov,max}$	$L_{Aeq,T2,mov,max}$	$L_{Ceq,T1,mov,max}$
$L_{Ceq,T2,mov,max}$	$\Delta L_{eq,T1,mov,max}$	$\Delta L_{eq,T2,mov,max}$

Weather Data (requires connection to a weather station):

Wind Dir. avg.	Wind Dir. min.	Wind Dir. max.
Wind Speed avg.	Wind Speed min.	Wind Speed max.
Amb. Temp.	Amb. Humidity	Amb. Pressure
Amb. Rain Gauge		

Only for Display as Numbers or Quasi-analog Bars:

L_{XS}	L_{XF}	L_{XI}
L_{YS}	L_{YF}	L_{YI}
$L_{XS(SPL)}$	$L_{XF(SPL)}$	$L_{XI(SPL)}$
$L_{YS(SPL)}$	$L_{YF(SPL)}$	$L_{YI(SPL)}$
L_{XN1} or L_{XUN1}	L_{XN2} or L_{XUN2}	L_{XN3} or L_{XUN3}
L_{XN4} or L_{XUN4}	L_{XN5} or L_{XUN5}	L_{XN6} or L_{XUN6}
L_{XN7} or L_{XUN7}	$L_{Vpeak,1s}$	Trig. Input Voltage
Std.Dev.	$L_{Aeq,T1,mov}$	$L_{Aeq,T2,mov}$
$L_{Ceq,T1,mov}$	$L_{Ceq,T2,mov}$	
$\Delta L_{eq,T1,mov}$	$\Delta L_{eq,T2,mov}$	

Instantaneous Weather Data:
Wind Dir. Wind Speed
Instantaneous GPS Data:
Latitude Longitude

MEASUREMENTS FOR VIBRATION AND DIRECT INPUT

For Display and Storage:

Start Time	Stop Time	Overload %
Elapsed Time	Time Remaining	
Linear	Fast max	Slow max
Fast min	Slow min	Peak
T_{Peak}		

Only for Display as Numbers or Quasi-analog Bars:
Fast Inst Slow Inst Trig. Input Voltage

Instantaneous GPS Data:
Latitude Longitude

MEASURING RANGES
When using Microphone Type 4189:
Dynamic Range: From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted: 16.6 to 140 dB
Primary Indicator Range: In accordance with IEC 60651: A-weighted: 23.5 dB to 122.3 dB
Linearity Range: In accordance with IEC 60804: A-weighted: 21.4 dB to 140.8 dB
Linear Operating Range: In accordance with IEC 61672:
- A-weighted: 1 kHz: 24.8 dB to 139.7 dB
- C-weighted: 25.5 dB to 139.7 dB
- Z-weighted: 30.6 dB to 139.7 dB

Peak C Range: In accordance with IEC 61672: 1 kHz: 42.3 dB to 142.7 dB

SAMPLING FOR STATISTICS
The Statistics can be based on either L_{XF}, L_{XS} or L_{Xeq}:
- Statistics L_{XFN1-7} or L_{XSN1-7} are based on sampling L_{XF} or L_{XS}, resp., every 10 ms into 0.2 dB wide classes over 130 dB
- Statistics L_{XN1-7} are based on sampling L_{Xeq} every second into 0.2 dB wide classes over 130 dB

Full distribution saved with measurement
The Std.Dev. (Standard Deviation) parameter is calculated from the statistics

Measurement Display and Control

MEASUREMENT DISPLAYS
SLM: Measurement data displayed as numbers of various sizes and one quasi-analog bar
Measured sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s2) or US/UK units (g)), direct data as voltage in dB or V, housekeeping data as numbers in relevant format.
Instantaneous measurement L_{XF} or Fast Inst is displayed as a quasi-analog bar

MEASUREMENT CONTROL
Manual: Manually controlled single measurement
Automatic: Pre-set measurement time from 1 s to 24 hr in 1 s steps
Manual Controls: Reset, Start, Pause, Back-erase, Continue and Store the measurement manually
Auto-start: A total of 10 timers allow set up of measurement start times up to a month in advance. Each timer can be repeated. Measurements are automatically stored when completed

BACK-ERASE
The last 5 s of data can be erased without resetting the measurement

Measurement Status

ON SCREEN
Information such as overload and running/paused are displayed on screen as icons

TRAFFIC LIGHTS
Red, yellow and green LEDs show measurement status and instantaneous overload as follows:
- Yellow LED flash every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

NOTIFICATIONS
Sends an SMS or e-mail daily at a specified time or if an alarm condition is fulfilled
Alarm Conditions:
- Disk Space below set value
- Trig. Input Voltage below set value
- Internal Battery enters set state
- Change in Measurement State
- Reboot of analyzer

Signal Monitoring

The input signal can be monitored using an earphone/headphones connected to the headphone socket, or it can be fed to the output socket

OUTPUT SIGNAL
Input Conditioned: A-, B-, C- or Z-weighted
Gain Adjustment: –60 dB to 60 dB
L_{XF} output (every ms) as a DC voltage between 0 V and 4 V
DC output for calibration purposes: 0 dB ~ 0 V and 200 dB ~ 4 V

HEADPHONE SIGNAL
Input signal can be monitored using this socket with headphones/earphones
Gain Adjustment: –60 dB to 60 dB

Annotations

VOICE ANNOTATIONS
Voice annotations can be attached to measurements so that verbal comments can be stored together with the measurement
Playback: Playback of voice annotations can be listened to using an earphone/headphones connected to the headphone socket
Gain Adjustment: –60 dB to +60 dB

TEXT ANNOTATIONS
Text annotations can be attached to measurements so that written comments can be stored with the measurement

GPS ANNOTATIONS
A text annotation with GPS information can be attached (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

IMAGE ANNOTATIONS (TYPE 2270 ONLY)
Image annotations can be attached to measurements. Images can be viewed on the screen.

Calibration

Initial calibration is stored for comparison with later calibrations

ACOUSTIC
Using Sound Calibrator Type 4231 or custom calibrator. The calibration process automatically detects the calibration level when Sound Calibrator Type 4231 is used

ELECTRICAL
Uses internally generated electrical signal combined with a typed-in value of microphone sensitivity

CALIBRATION HISTORY
Up to 20 of the last calibrations made are listed and can be viewed on the analyzer

Data Management

METADATA
Up to 30 metadata annotations can be set per project (text from keyboard or text from pick list, number from keyboard or auto generated number)

PROJECT TEMPLATE
Defines the display and measurement setups. Setups can be locked and password protected

PROJECT
Measurement data stored with the project template

JOB
Projects are organised in jobs
Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)

Software Specifications – Frequency Analysis Software BZ-7223

The specifications for BZ-7223 include the specifications for Sound Level Meter Software BZ-7222. BZ-7223 adds:

Standards

Conforms with the following National and International Standards:
- IEC 61260 (1995–07) plus Amendment 1 (2001–09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11–1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0–C
- ANSI S1.11– 2004, 1/1-octave Bands and 1/3-octave Bands, Class 0

Input

CHANNELS (TYPE 2270 ONLY)
All measurements are made from either Ch.1 or Ch.2

Frequency Analysis

CENTRE FREQUENCIES
1/1-oct. Band Centre Frequencies: 8 Hz to 16 kHz
1/3-oct. Band Centre Frequencies: 6.3 Hz to 20 kHz

MEASUREMENTS FOR SOUND INPUT
X = frequency weightings A, B, C or Z, Y = time weightings F or S
Data for Storage
Full Spectral Statistics

Spectra for Display and Storage

L_{Xeq}	L_{XSmax}	L_{XFmax}
L_{XSmin}	L_{XFmin}	

Spectra for Display Only

L_{XS}	L_{XF}	L_{XYN1}
L_{XYN2}	L_{XYN3}	L_{XYN4}
L_{XYN5}	L_{XYN6}	L_{XYN7}

Single Values

SIL	PSIL	SIL3
$L_{Xeq}(f1\text{-}f2)^*$		
NR	NR Decisive Band	
RC	RC Classification	
NCB	NCB Classification	
NC	NC Decisive Band	
Loudness	Loudness Level	

*. where f1 and f2 are frequency bands in the spectrum.

MEASUREMENTS FOR VIBRATION AND DIRECT INPUT

Spectra for Display and Storage

Linear	Fast max	Slow max
Fast min	Slow min	

Spectra for Display Only

Fast Inst	Slow Inst

Single Values
Linear (f1 – f2)[a]

MEASURING RANGES
When using Microphone Type 4189:
Dynamic Range: From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave: 1.1 to 140 dB

Linear Operating Range: In accordance with IEC 61260, 1/3-octave: ≤ 20.5 to 140 dB

SAMPLING FOR OCTAVE OR 1/3-OCTAVE STATISTICS

X = frequency weightings A or B

The Statistics can be based on either L_{XF} or L_{XS}:

- Statistics L_{XFN1-7} or L_{XSN1-7} are based on sampling L_{XF} or L_{XS}, respectively, every T ms into 1 dB wide classes over 150 dB;

T = 100 for frequency range set to 12.5 – 20 kHz

T = 200 for frequency range set to 6.3 – 20 kHz

Full distribution can be saved with measurement

Displays

MEASUREMENT DISPLAYS

Spectrum: One or two spectra superimposed + A/B and C/Z broadband bars

Table: One or two spectra in tabular form

Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto zoom or auto scale available. Sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s2) or US/UK units (g)), direct data as voltage in dB or V.

Cursor: Readout of selected band

Generator

INTERNAL GENERATOR

Built-in pseudo-random noise generator

Spectrum: Selectable between Pink and White

Crest Factor:

Pink Noise: 4.4 (13 dB)

White Noise: 3.6 (11 dB)

Bandwidth: Selectable:

- Lower Limit: 50 Hz (1/3-oct.) or 63 Hz (oct.)
- Upper Limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)

Output Level: Independent of bandwidth

- Max.: 1 Vrms (0 dB)
- Gain Adjustment: –60 to 0 dB

When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level

Correction Filters: For sound sources Type 4292, Type 4295 and Type 4296: Flat or Optimum

Repetition Period: 175 s

Output Connector: Output socket

EXTERNAL GENERATOR

Selectable as alternative to Internal Generator (for microphone input only)

To control external noise generator, set:

- **Levels:** 0 V (Generator off), 4.5 V (Generator on)
- **Rise-time and Fall-time:** 10 µs

The noise generator is turned on and off automatically during the measurement

Escape Time: 0 to 60 s

Build-up Time: 1 to 10 s

The generator can be turned on and off manually for checking equipment and sound levels

Software Specifications – Logging Software BZ-7224

The specifications for BZ-7224 include the specifications for Sound Level Meter Software BZ-7222. BZ-7224 adds:

Logging

MEASUREMENTS

Logging: Measurement data logged at pre-set periods into files on:

- SD Card: All hardware versions
- CF Card: Hardware versions 1 – 3
- USB Memory Stick: Hardware version 4

Logging Period: From 1 s to 24 hr with 1 s resolution

Fast Logging: L_{AF}, L_{AS} and L_{Aeq} (sound input) or Fast Inst, Slow Inst and Linear (vibration and Direct input) can be logged every 100 ms, irrespective of logging period

Broadband Data Stored at each Logging Interval: All, or up to 10 selectable broadband sound data incl. Trig. Input Voltage, Weather data, and $L_{Aeq,T,mov}$ (for vibration and direct input: up to 5 parameters)

Broadband Statistics Stored at each Logging Interval: Full distribution, or none (sound input only)

Spectrum Data Stored at each Logging Interval: All, or up to three selectable spectra (license for BZ-7223 required)

Spectral Statistics Stored at each Logging Interval: Full distribution, or none (sound input only, license for BZ-7223 required)

Logging Time: From 1 s to 31 days with 1 s resolution

Measurement Total: For the logging time, in parallel with logging: All broadband data, statistics and spectra (license for BZ-7223 required)

MARKERS

One data exclusion marker and four user-definable markers for on-line marking of sound categories heard during the measurement

Events can be set manually

TRIGGERS
Markers can be set and signal recordings can be started (license for BZ-7226 required) when a broadband level is above or below a specified level

ANNOTATIONS
On-line annotations with spoken comments, written notes or images (Type 2270 only)

Calibration

CHARGE INJECTION CALIBRATION (CIC)
Injects an internally generated electrical signal in parallel with the microphone diaphragm. A manual CIC can be performed whenever there is no measurement in progress
An automatic CIC can be performed at the start and end of a logging measurement

Measurement Displays

Profile: Graphical display of selectable measurement data versus time. Fast display of next or previous marker, profile overview of entire measurement
Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto zoom or auto scale available. Sound data are displayed as dB values, vibration data as dB values or in physical units (SI units (m/s2) or US/UK units (g)), direct data as voltage in dB or V.
X-axis: Scroll facilities
Cursor: Readout of measurement data at selected time

Notifications

Alarm Conditions (in addition to those specified for BZ-7222):
- CIC failed
- Trigger Level exceeded

Software Specifications – Enhanced Logging Software BZ-7225

The specifications for BZ-7225 include the specifications for Logging Software BZ-7224. BZ-7225 adds:

Logging

For Display and Storage
L_{dn}, L_{den}, L_{day}, $L_{evening}$ and L_{night}
Selectable Day, Evening and Night periods and penalties (sound input only)
Periodic Reports: Measurement data logged at a preset report period into files on:
- SD Card: All hardware versions
- CF Card: Hardware versions 1 – 3
- USB Memory Stick: Hardware version 4

Report Period: From 1 min to 24 hr with 1 min resolution
Broadband Data and Statistics Stored at each Reporting Interval: All including Weather data
Spectrum Data Stored at each Reporting Interval: All (license for BZ-7223 required)
Spectral Statistics Stored at each Reporting Interval: Full distribution, or none (sound input only, license for BZ-7223 required)
Logging Time: From 1 s to 31 days with 1 s resolution or Continuous
Data are saved in separate projects for every 24 hr of logging – at a user-defined time of day
Automatic reboot and resume of operation in case of power failure

TRIGGERS
Signal Recording Timer
For periodically starting a signal recording (license for BZ-7226 required)
Level Triggers
Markers can be set and signal recordings can be started (license for BZ-7226 required) when a broadband or frequency band level is above or below a specified level. Hold off time between triggers can be set. You can specify up to four independent Level Triggers to be active at four different times during the day

Calibration

CHARGE INJECTION CALIBRATION (CIC)
Injects an internally generated electrical signal in parallel with the microphone diaphragm. A manual CIC can be performed whenever there is no measurement in progress
An automatic CIC can be performed at the start and end of a logging measurement. The CIC can be set to occur up to 4 times in each 24 hour period
CIC Duration: 10 s

Notifications

Alarm Conditions (in addition to those specified for BZ-7224): L_{Aeq} for the latest Report Period exceeds a set threshold

Software Specifications – Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 is enabled with a separate license. It works with all the software for Type 2250/2270: Sound Level Meter, Frequency Analysis, Logging Software, Enhanced Logging Software and Reverberation Time Software
For data storage, Signal Recording requires:
- SD Card: All hardware versions
- CF Card: Hardware versions 1 – 3
- USB Memory Stick: Hardware version 4

RECORDED SIGNAL
A-, B-, C- or Z-weighted signal from the measurement transducer

AUTOMATIC GAIN CONTROL
The average level of the signal is kept within a 40 dB range, or the gain can be fixed

SAMPLING RATE AND PRE-RECORDING
The signal is buffered for the pre-recording of the signal. This allows the beginning of events to be recorded even if they are only detected later.

Sampling Rate (kHz)	Maximum Pre-recording (s) 16-bit		Maximum Pre-recording (s) 24-bit		Memory (KB/s) 16-bit	Memory (KB/s) 24-bit
	HW 1 – 3	HW G4	HW 1 – 3	HW G4		
8	110	470	70	310	16	24
16	50	230	30	150	32	48
24	30	150	16	96	48	72
48	10	70	3	43	96	144

PLAYBACK
Playback of signal recordings can be listened to using the earphone/headphones connected to the headphone socket

RECORDING FORMAT
The recording format is either 24- or 16-bit wave files (extension .WAV) attached to the data in the project, easily played-back afterwards on a PC using BZ-5503, Type 7820 or 7825. Calibration information is stored in the .WAV file, allowing BZ-5503 and PULSE to analyse the recordings

Functions with BZ-7222 and BZ-7223

Manual Control of Recording: Recording can be manually started and stopped during a measurement using a pushbutton or an external signal
Automatic Control of Recording: Start of recording when measurement is started. Minimum and Maximum recording time can be preset

Functions with BZ-7224 and BZ-7225

Manual Control of Recording (using Manual Event or Back-erase pushbutton, or an external signal): Recording during all of the event, or for preset minimum and maximum duration. A Sound marker is set while recording. Selectable pre- and post-recording time
Manual Control of Recording (using touch screen): Recording for the selected time period (subject to the limitations of the pre-recording buffer). A Sound marker is set for the selected time period
Automatic Control of Recording: An event can be triggered when a broadband level is above or below a specified level. Recording during all of the event or for preset minimum and maximum duration. Selectable pre- and post-recording time

Functions with BZ-7227

Automatic Control of Recording: Start of recording when measurement is started
16-bit recording format only

Software Specifications – Reverberation Time Software BZ-7227

Standards

Conforms with the relevant parts of the following:
- IEC 61672 –1 (2013) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993–02) and Amendment 2 (2000–10), Type 1
- ANSI S1.4–1983 plus ANSI S1.4A–1985 Amendment, Type 1
- IEC 61260 (1995–07) plus Amendment 1 (2001–09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11–1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0–C
- ANSI S1.11– 2004, 1/1-octave Bands and 1/3-octave Bands, Class 0
- ISO 140
- ISO 3382
- ISO 354

CORRECTION FILTERS
For Microphone Types 4189, 4190, 4191, 4193, 4950, 4952, 4952+EH-2152, 4955-A, 4964 and 4184-A, BZ-7227 is able to correct the frequency response to compensate for sound field and accessories

Broadband Measurements

DETECTORS
A- and C-weighted broadband detectors with F exponential time weighting
Overload Detector: Monitors the overload outputs of all the frequency weighted channels

MEASUREMENTS
L_{AF} and L_{CF} for Display as Numbers or Quasi-analogue Bars

MEASURING RANGES
When using Microphone Type 4189:
Dynamic Range: From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted: 16.6 to 140 dB
Primary Indicator Range: In accordance with IEC 60651, A-weighted: 23.5 dB to 122.3 dB
Linear Operating Range: In accordance with IEC 61672:
- A-weighted: 23.5 dB to 122.3 dB
- C-weighted: 25.5 dB to 139.7 dB
- Z-weighted: 30.6 dB to 139.7 dB

Frequency Analysis

CENTRE FREQUENCIES
1/1-oct. Band Centre Frequencies: 63 Hz to 8 kHz
1/3-oct. Band Centre Frequencies: 50 Hz to 10 kHz

MEASUREMENTS
L_{ZF} spectrum for display only
L_{Zeq} spectra sampled at 5 ms intervals

MEASURING RANGES
When using Microphone Type 4189:
Dynamic Range: From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave: 1.1 to 140 dB
Linear Operating Range: In accordance with IEC 61260, 1/3-octave: $\leq$20.5 dB to 140 dB

Internal Generator

Built-in pseudo-random noise generator
Spectrum: Selectable Pink or White
Crest Factor:
- Pink noise: 4.4 (13 dB)
- White noise: 3.6 (11 dB)

Bandwidth: Follows measurement frequency range
- Lower Limit: 50 Hz (1/3-oct.) or 63 Hz (oct.)
- Upper Limit: 10 kHz (1/3-oct.) or 8 kHz (oct.)

Output Level: Independent of bandwidth
- Max.: 1 Vrms (0 dB)
- Gain Adjustment: –60 to 0 dB

When bandwidth is changed, the level for all bands is automatically adjusted to comply with the set output level
Correction Filters for Sound Sources Type 4292, Type 4295 and Type 4296: Flat or Optimum
Turn-on Time and Turn-off Time: Equivalent to RT = 70 ms
Repetition Period: 175 s
Output Connector: Output Socket
Control: See Measurement Control

External Generator

Selectable as alternative to internal generator
For controlling external noise generator
Levels: 0 V (Generator off), 4.5 V (Generator on)
Rise-time and Fall-time: 10 μs
Control: See Measurement Control

Reverberation Time

EDT, T20 and T30 in octave or 1/3-octave bands
Decays: Measured and stored using averaging time of 5 ms
Evaluation Range: 0 to –10 dB for EDT, –5 to –25 dB for T20 and –5 to –35 dB for T30
Measurement Time: Automatic selection of measurement time for the decays based on the actual reverberation time of the room
Maximum Measurement Time: from 2 to 30 s
Averaging: EDT, T20 and T30 measurements can be averaged (arithmetic averaging or ensemble averaging)
EDT, T20 and T30 Calculation: From slope in evaluation range
Slope Estimation: Least squares approximation
Quality Indicators: Quality Indicators with status information like Overload, Curvature in %, etc.; extensive list of status information.
Quality indicators are available on reverberation time spectra for each frequency band, and as overall quality indicators for each measurement position and for the total project (room)
Reverberation Time Range: Max. 50 s, min. 0.1 – 0.7 s, depending on bandwidth and centre frequency
Wide Band Reverberation Time: The arithmetic average of the Reverberation Time within a selectable

Measurement Display and Control

OVERVIEW MAP
Map of Source and Receiver positions with reverberation time readout for a selectable frequency band on each measurement position together with quality indicator
Organisation of Source and Receiver Positions: measure at all receiver positions for each source or measure in a number of positions (1 to 10) for each source
Source and Receiver positions can be added, moved or deleted

OVERVIEW TABLE
Table of measurement positions with reverberation time readout for selectable frequency band on each position together with quality indicator
Positions can be included/excluded from Room average

SOUND LEVEL SPECTRUM
LZF spectrum plus A and C broadband bars
Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto zoom or auto scale available
Cursor: Readout of selected band
Quality indicator for each frequency band

REVERBERATION TIME SPECTRUM
One or two spectra can be displayed
Y-axis: Range: 0.5, 1, 2, 5, 10 or 20 s. Auto zoom available
Cursor: Readout of selected band
Quality Indicator for each frequency band

REVERBERATION TIME SPECTRUM TABLE
One or two spectra can be displayed in tabular form

DECAY
Decay curve for a position or the room average available for each frequency band
Display of evaluation range and regression line
Readout of Curvature in %
Y-axis: Range: 5, 10, 20, 40, 60, 80, 100, 120, 140 or 160 dB. Auto zoom or auto scale available

MEASUREMENT CONTROL
Measurement Sequence: Supports measuring:
- at all receiver positions before using another source
- at a receiver position for all sources before measuring at a new position
- at subsequent receiver positions without source information, or
- at manually selected source and receiver positions

During measurement, the instantaneous sound level spectrum is displayed. After measurement, the reverberation time is displayed

Interrupted Noise Excitation: Measurements are started manually and can be automatically stored on completion of measurement
The noise generator is turned on and off automatically
Escape Time: 0 to 60 s
Build-up Time: 1 to 10 s
Number of Decays per Measurement: 1 to 100, ensemble averaged into one decay
The generator can be turned on and off manually for checking equipment and sound levels
Serial Measurements: Selected frequency bands can be measured serially, that is, one by one in an automatic sequence. This can be done automatically in combination with the parallel measurement
Impulse Excitation: Manual start of first measurement. When level (say from starter pistol) exceeds the user-selected trigger level, the decay is recorded and backwards integration performed (Schroeder method). The trigger can then be armed automatically for measuring at the next position
Signal Recording: (requires license for Signal Recording Option BZ-7226) Recording of the Z-weighted measured signal can be done at each position. For data storage, Signal Recording requires:
- SD Card: All hardware versions
- CF Card: Hardware versions 1 – 3
- USB Memory Stick: Hardware version 4

Measurement Status

ON SCREEN
Information such as *overload*, *awaiting trigger* and *running/paused* are displayed on screen as icons

TRAFFIC LIGHT
Red, yellow and green LEDs show measurement status and instantaneous overload as follows:
- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting trigger or calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

Calibration

Initial calibration is stored for comparison with later calibrations

ACOUSTIC
Using Sound Calibrator Type 4231 or custom calibrator. The calibration process automatically detects the calibration level when Sound Calibrator Type 4231 is used

ELECTRICAL
Uses internally generated electrical signal combined with a typed-in value of microphone sensitivity

CALIBRATION HISTORY
Up to 20 of the last calibrations made are listed and can be viewed on the analyzer

Signal Monitoring

Input signal A-, C- or Z-weighted can be monitored using an earphone/headphones connected to the headphone socket
Headphone Signal: Input signal can be monitored using this socket with headphones/earphones
Gain Adjustment: –60 dB to 60 dB

Annotations

VOICE ANNOTATIONS
Voice annotations can be attached to the Reverberation Time Project, to Sources, to Receivers and to measurements at each Position
Playback: Playback of voice annotations or signal recordings can be listened to using earphone/headphones connected to the headphone socket
Gain Adjustment: –60 dB to +60 dB

TEXT & IMAGE ANNOTATIONS
Text and image (Type 2270 only) annotations can be attached to the Reverberation Time Project, to Sources, to Receivers and to measurements at each Position

GPS ANNOTATIONS
A text annotation with GPS information can be attached to the project (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

Data Management

Project Template: Defines the display and measurement setups
Project: Measurement data for all positions defined in a room are stored with the Project Template
Job: Projects are organised in Jobs
Explorer facilities for easy management of data (copy, cut, paste, delete, rename, open project, create job, set default project name)
For specifications and details on documenting results in Qualifier Type 7830 and Qualifier Light Type 7831, please refer to Product Data BP 1691

Software Specifications – 2-channel Option BZ-7229

2-channel Option BZ-7229 is enabled with a separate license. It adds 2-channel functionality to Sound Level Meter, Frequency Analysis, Logging, Enhanced Logging and Building Acoustics Software and to Signal recording option on Type 2270.
Note: 2-channel Enhanced Logging is not available for hardware versions 1-3.
Please refer to Product Data BP 2190 for Dual-channel Building Acoustics Software specifications
In general the 2-channel Option adds an extra channel of measurement data. The two channels can have input from same type of transducers (e.g., two microphones) or two different transducers (e.g., one microphone and one accelerometer)

SELF-GENERATED NOISE LEVEL
Typical values at 23°C for nominal microphone open-circuit sensitivity:

High Range:

Weighting	Microphone	Electrical	Total
“A”	14.6 dB	28.3 dB	28.5 dB
“B”	13.4 dB	26.9 dB	27.1 dB
“C”	13.5 dB	27.0 dB	27.2 dB
“Z” 5 Hz–20 kHz	15.3 dB	31.2 dB	31.3 dB
“Z” 3 Hz–20 kHz	15.3 dB	32.1 dB	32.2 dB

Low Range:

Weighting	Microphone	Electrical	Total
“A”	14.6 dB	12.4 dB	16.6 dB
“B”	13.4 dB	11.5 dB	15.6 dB
“C”	13.5 dB	12.9 dB	16.2 dB
“Z” 5 Hz–20 kHz	15.3 dB	18.3 dB	20.1 dB
“Z” 3 Hz–20 kHz	15.3 dB	25.5 dB	25.9 dB

MEASURING RANGES
The full level measuring range is covered in two range settings: High Range for the least sensitive range and Low Range for the most sensitive range
When using Microphone Type 4189:

Broadband Analysis
Dynamic Range: From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted:
- High Range: 28.5 to 140 dB
- Low Range: 16.6 to 110 dB

Primary Indicator Range: In accordance with IEC 60651, A-weighted:
- High Range: 41.7 dB to 122.3 dB
- Low Range: 23.5 dB to 92.3 dB

Linearity Range: In accordance with IEC 60804, A-weighted:
- High Range: 39.6 to 140.8 dB
- Low Range: 21.4 to 110.8 dB

Linear Operating Range: In accordance with IEC 61672:
- A-weighted: 1 kHz
  - High Range: 43.0 dB to 139.7 dB
  - Low Range: 24.8 dB to 109.7 dB
- C-weighted: 1 kHz
  - High Range: 41.7 dB to 139.7 dB
  - Low Range: 25.5 dB to 109.7 dB
- Z-weighted: 1 kHz
  - High Range: 45.9 dB to 139.7 dB
  - Low Range: 30.6 dB to 109.7 dB

Peak C Range: In accordance with IEC 61672, 1 kHz:
- High Range: 58.5 dB to 142.7 dB
- Low Range: 42.3 dB to 112.7 dB

Frequency Analysis
Dynamic Range: From typical noise floor to max. level for a pure tone signal at 1 kHz 1/3-octave:
- High Range: 18.5 to 140 dB
- Low Range: 1.3 to 110 dB

Linear Operating Range: In accordance with IEC 61260:
- High Range: ≤ 39.3 to 140 dB
- Low Range: ≤ 20.6 to 110 dB

Measurements with BZ-7222 and BZ-7223

Two channels, each with all the data from the single channel measurement, except for common housekeeping parameters like Start Time, Elapsed Time etc. and weather and GPS data.

Underrange Detector: Monitors the underrange of all the frequency-weighted detectors when set to High Range. Underrange is set if level is below lower limit of Linear Operating Range. Detectors available for both Ch. 1 and Ch. 2

AUTORANGE
Manual and automatic range controls are provided
Spectrum Display (for BZ-7223)
Spectra from both channels can be superimposed. Data from different transducer types are displayed with individual Y-axis
Spectra for Display (Microphone Input):
- Ch.1 - Ch.2 LX_{eq}
- Ch.2 - Ch.1 LX_{eq}

X = A,B,C,Z
Spectra for Display (Accelerometer or Direct Input):
- Ch.1 - Ch.2 Linear
- Ch.2 - Ch.1 Linear

Single Values for Display (Microphone Input):
- Ch.1-Ch.2 LX_{eq}
- Ch.2-Ch.1 LX_{eq}
- Ch.1-Ch.2 LY_{eq}
- Ch.2-Ch.1 LY_{eq}

X = A, B. Y = C, Z
Single Values for Display (accelerometer or direct input):
- Ch.1 - Ch.2 Linear
- Ch.2 - Ch.1 Linear

Measurements with BZ-7224 and BZ-7225

Fast Logging: Up to a total of four of the 100 ms parameters from the two channels can be logged.
Broadband Data Stored at Each Logging Interval: All, or up to 10 selectable broadband values from the two channels.
Spectrum Data Stored at each Logging Interval: All, or up to four selectable spectra from the two channels (license for BZ-7223 required)
2-channel Signal Recording (license for BZ-7226 required):
2-channel Signal Recording is available in Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software
The signals from the two channels can be recorded into a “stereo” wave file of either 2 × 24-bit or 2 × 16-bit

Note: 2 × 24-bit at 48 kHz is not available for hardware versions 1–3

SAMPLING RATE AND PRE-RECORDING FOR 2-CHANNEL RECORDING

Sampling Rate (kHz)	Maximum Pre-recording (s) 16-bit		Maximum Pre-recording (s) 24-bit		Memory (KB/s) 16-bit	Memory (KB/s) 24-bit
	HW 1 – 3	HW G4	HW 1 – 3	HW G4		
8	50	230	30	150	32	48
16	20	110	10	70	64	96
24	10	70	3	43	96	144
48	0	30	NA	16	192	288

Software Specifications – Tone Assessment Option BZ-7231

LICENSE
Tone Assessment Option BZ-7231 is enabled with a separate license and can be used with the FFT template (BZ-7230) or with 1/3-octave and logging template (BZ-7223, BZ-7224 and BZ-7225)

FFT Based Tone Assessment (with BZ-7230 Only)

STANDARD
Tone assessment is based on the measured FFT spectrum in accordance with 'ISO 1996:2007 Acoustics – Description, assessment and measurement of environmental noise – part 2: Determination of environmental noise levels. Annex C (informative) Objective method for assessing the audibility of tones in noise – Reference method'

SPECTRA ASSESSED
Any displayed sound FFT spectrum (FFT, Ref or MAX) may be assessed
Assessment is made as post-processing, that is, when measurement is paused or stopped

SETUP ACCORDING TO STANDARD
Setups in violation of the standard are indicated as such on the display, you may then accept to apply the default setup
Tone assessment will be made if possible, in spite of standard violations
Tone Seek Criterion: 0.1 to 4.0 dB in 0.1 dB steps

TONE AT CURSOR
A sinusoidal tone is available at the Headphone output, to help confirm identified tones
Frequency: the frequency is selected by the Main cursor
Gain: –70 dB to +10 dB
Options: The generated tone can be mixed with the input signal

TONE ASSESSMENT CURSOR
All tones found are indicated in the display.
The Tone cursor is initially placed at the most prominent tone, and can then be stepped through the tones found.
You can also use the Main cursor to step through the tones

RESULTS
Results are displayed in the Tone panel and in the Value panel
They are not saved with the measurement
All Tones: Frequency, Tone level L_{pti}, Masking noise level L_{pn}, Audibility ΔL_{ta}, Critical Band CB, Tone vs. Noise Level difference ΔL_{ts}, Audibility criterion $\Delta L_{ts,krit}$
Most Prominent Tone: Tone Level L_{pt}, Adjustment K_t

QUALITY INDICATORS
On the display, a quality indicator (smiley) will indicate that a hint is available for tone assessment quality. Click on the indicator to see the hint

1/3-octave Based Tone Assessment (with BZ-7223/24/25 Only)

Tone assessment is based on the measured 1/3-octave spectrum in accordance with either the international 'ISO 1996:2007 Acoustics – Description, assessment and measurement of environmental noise – part 2: Determination of environmental noise levels. Annex D (informative) Objective method for assessing the audibility of tones in noise – Simplified method' or the Italian law 'DM 16-03-1998: Ministero dell'ambiente, Decreto 16 marzo 1998'

SPECTRA ASSESSED
The displayed 1/3-octave spectrum (L_{eq}, L_{max} or L_{min}) may be assessed. Assessment is made as post-processing, that is, when measurement is paused or stopped

SETUP ACCORDING TO STANDARD
Setups in violation of the standard are indicated as such on the display. You can then accept to apply the default setup. Tone assessment will be made if possible, in spite of standard violations. For tone assessment according to ISO 1996-2, Annex D, you can set the division between the Low and Middle frequency range, the division between the Middle and High frequency range, and the limits for the level differences between adjacent bands.
For tone assessment according to DM 16-03-1998, the tones are tested against loudness contours. Select between ISO 226: 1987 Free-field, 1987 Diffuse-field and 2003 Free-field

RESULTS
Tones are indicated above the spectrum when *Tone* is selected as spectrum parameter. The resulting adjustment can be viewed on the Value panel. It is not saved with the measurement

QUALITY INDICATORS
On the display, a quality indicator (smiley) will indicate that a hint is available for tone assessment quality. Click on the indicator to see the hint

Software Specifications – Low Frequency Option BZ-7234

Low Frequency Option BZ-7234 is enabled with a separate license. It adds G-weighting and Building Vibration parameters to Sound Level Meter, Frequency Analysis, Logging and Enhanced Logging Software and adds low frequency 1/1- and 1/3-octave analysis to Frequency Analysis, Logging and Enhanced Logging Software.

G-weighting

Specifications for G-weighing apply to Type 2250/2270 fitted with one of the microphone Types 4193 or 4964 (both with or without the Low Frequency Adaptor UC-0211) and Microphone Preamplifier ZC-0032

Standards

Conforms with the following National and International Standards:
- ISO 7196:1995
- ANSI S1.42–2001 (R2011)

Analysis

DETECTORS
G-weighted (replacing C/Z-weighted) broadband detectors with one 10 s exponential time weighting, one linearly averaging detector and one peak detector.

MEASUREMENTS
Y = time weightings F or S

Spectra for Display and Storage (BZ-7223 required)

L_{Geq} L_{GSmax} L_{GFmax}
L_{GSmin} L_{GFmin}

Spectra for Display Only (BZ-7223 required)

L_{GS} L_{GF} L_{GYN1}
L_{GYN2} L_{GYN3} L_{GYN4}
L_{GYN5} L_{GYN6} L_{GYN7}

Single Values for Display and Storage

L_{Geq} L_{G10max} L_{G10min}
L_{Gpeak} T_{Gpeak}

Single Values for Display Only

L_{G10} $L_{Gpeak,1s}$

MEASURING RANGES
G-weighted Linear Operating Range at G-filter reference frequency 10 Hz, Single Range
Single Range:.

Microphone	Low (dB)	High (dB)
4193	41.0	161.0
4194 + UC-0211	44.1	151.4
4964	29.6	149.0
4964 + UC-0211	32.6	139.3

High Range:

Microphone	Low (dB)	High (dB)
4193	41.6	161.0
4194 + UC-0211	51.8	151.4
4964	30.3	149.0
4964 + UC-0211	41.7	139.3

Low Range:

Microphone	Low (dB)	High (dB)
4193	41.0	131.0
4194 + UC-0211	44.1	147.4
4964	29.6	119.0
4964 + UC-0211	32.6	137.3

Building Vibration

Specifications for Building Vibration parameters apply to Type 2250/2270 fitted with an accelerometer.

Standards

Conforms with the following International Standards:
- ISO 8041:2005
- DIN 45669-1:2010–09

Analysis

DETECTORS
Wm-weighted or Wmb-weighted detectors run in parallel with the Linear weighted broadband detectors. Wmb is the band-limiting part of the Wm weighting.

MEASUREMENTS
Spectra for Display and Storage (BZ-7223 required)

aW	Fast max	Slow max
Fast min	Slow min	

Spectra for Display Only (BZ-7223 required)

Fast Inst	Slow Inst

Single Values for Display and Storage

aW	aW_{Crest}	MTVV
KBF_{max}	KBF_{Tm}	Peak
T_{Peak}		

Single Values for Display Only

aW,1s	KBF

Low Frequency 1/1- and 1/3-octave Analysis

Frequency Analysis

CENTRE FREQUENCIES
1/1-oct. Band Centre Frequencies: 1 Hz to 16 kHz
1/3-oct. Band Centre Frequencies: 0.8 Hz to 20 kHz

Standards

Conforms with the following National and International Standards:
- IEC 61260 (1995–07) plus Amendment 1 (2001–09), 1/1-octave Bands and 1/3-octave Bands, Class 0
- ANSI S1.11–1986, 1/1-octave Bands and 1/3-octave Bands, Order 3, Type 0–C
- ANSI S1.11–2004, 1/1-octave Bands and 1/3-octave Bands, Class 0

Sound Measurements

Low frequency sound measurements require use of a low frequency microphone. This can be the Type 4193 or Type 4964, both together with Low Frequency Adaptor UC-0211

Vibration Measurements

Brüel & Kjær recommends Low-level Accelerometer Type 8344 for low frequency vibration measurements

Software Specifications – Measurement Partner Suite BZ-5503

BZ-5503 is included with Types 2250, 2270 and 2250 Light (referred to as Type 2250/70 here) for easy synchronisation of setups and data between the PC and hand-held analyzer. BZ-5503 is supplied on ENV DVD BZ-5298

PC REQUIREMENTS
Operating System: Windows® 7 or XP (both in 32-bit or 64-bit versions)

Recommended PC:
- Intel® Core™ 2 Duo
- Microsoft®.NET 4.0
- 2 GB of memory
- Sound card
- DVD drive
- At least one available USB port

ON-LINE DISPLAY OF TYPE 2250/2270 DATA
Measurements on Type 2250/2270 can be controlled from the PC and displayed on-line with the PC, using the same user interface on the PC as on Type 2250/2270
Display: 1024 × 768 (1280 × 800 recommended)

DATA MANAGEMENT
Explorer: Facilities for easy management of analyzers, Users, Jobs, Projects and Project Templates (copy, cut, paste, delete, rename, create)
Data Viewer: View measurement data (content of projects)
Synchronisation: Project Templates and Projects for a specific user can be synchronised between PC and Type 2250/2270

USERS
Users of Type 2250/2270 can be created or deleted

EXPORT FACILITIES
Excel: Projects (or user-specified parts) can be exported to Microsoft® Excel® (Excel 2003 – 2010 supported)
Brüel & Kjær Software: Projects can be exported to Predictor-LimA Type 7810, Acoustic Determinator Type 7816, Evaluator Type 7820, Protector Type 7825 or Qualifier (Light) Type 7830 (7831)

POST-PROCESSING
Measurement Partner Suite is a suite of modules, including post-processing tools for data acquired with Type 2250/2270. The following post-processing modules are available:
- Logging Module BZ-5503-A
- Spectrum Module BZ-5503-B
- WAV File Analysis Module BZ-5503-C

These two modules help to assess logging data and measured spectra, such as calculating contribution from markers on a logging profile or correcting spectra for background noise

TYPE 2250/2270 SOFTWARE UPGRADES AND LICENSES
The software controls Type 2250/2270 software upgrades and licensing of the Type 2250/2270 applications

INTERFACE TO TYPE 2250/2270
USB, LAN or Internet connection
USB Connection:
- Hardware versions 1 – 3: USB ver. 1.1
- Hardware version 4: USB ver. 2.0

LICENSE MOVER
To move a license from one analyzer to another use BZ-5503, together with the License Mover VP-0647. See the analyzer's user manual for details

LANGUAGE
User Interface in Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish, Turkish and Ukrainian

HELP
Concise context-sensitive help in English

Ordering Information

Type 2250-A	Hand-held Analyzer with Sound Level Meter Software BZ-7222
Type 2250-B	Hand-held Analyzer with Sound Level Meter BZ-7222 and Frequency Analysis Software BZ-7223
Type 2250-C	Hand-held Analyzer with Sound Level Meter Software BZ-7222 and Logging Software BZ-7224
Type 2250-D	Hand-held Analyzer with Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223 and Logging Software BZ-7224
Type 2250-E	Hand-held Analyzer with Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223, Enhanced Logging Software BZ-7225 and Signal Recording Software BZ-7226
Type 2270-A	Hand-held Analyzer with Sound Level Meter Software BZ-7222
Type 2270-B	Hand-held Analyzer with Sound Level Meter BZ-7222 and Frequency Analysis Software BZ-7223
Type 2270-C	Hand-held Analyzer with Sound Level Meter Software BZ-7222 and Logging Software BZ-7224

Type 2270-D Hand-held Analyzer with Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223 and Logging Software BZ-7224

Type 2270-E Hand-held Analyzer with Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223, Enhanced Logging Software BZ-7225 and Signal Recording Software BZ-7226

Included with Hand-held Analyzer Type 2250/2270:

- Microphone:
  - Type 4189: 1/2″ Prepolarized Free-field Microphone
    or
  - Type 4190: 1/2″ Free-field Microphone
- ZC-0032: Microphone Preamplifier
- AO-1494: USB Standard A to USB Micro B Interface Cable for hardware version 4, 1.8 m (6 ft)
- AO-1476: USB Standard A to USB Mini B Interface Cable for hardware versions 1 – 3, 1.8 m (6 ft)
- BZ-5298: Environmental Software, including Measurement Partner Suite BZ-5503
- UA-1650: 90 mm dia. Windscreen with AutoDetect
- UA-1651: Tripod Extension for Hand-held Analyzer
- UA-1673: Adaptor for Standard Tripod Mount
- DH-0696: Wrist Strap
- KE-0440: Travel Bag
- KE-0441: Protective Cover
- FB-0679: Hinged Cover (Type 2250 only)
- FB-0699: Hinged Cover (Type 2270 only)
- HT-0015: Earphones
- UA-1654: 5 Extra Styli
- QB-0061: Battery Pack
- ZG-0426: Mains Power Supply

Software and Accessories Available Separately

SOFTWARE MODULES

BZ-7223	Frequency Analysis Software
BZ-7224	Logging Software (including memory card)
BZ-7225	Enhanced Logging Software (including memory card)
BZ-7225-UPG	Upgrade from Logging Software BZ-7224 to Enhanced Logging Software BZ-7225 (does not include memory card)
BZ-7226	Signal Recording Option
BZ-7227	Reverberation Time Software
BZ-7229	2-channel Option (Type 2270 only)
BZ-7228	Building Acoustics Software
BZ-7230	FFT Software
BZ-7231	Tone Assessment Option
BZ-7233	Sound Intensity Software (Type 2270 only)
BZ-7234	Low Frequency Option

ANALYZER COMPONENTS

ZG-0444	Charger for QB-0061 Battery Pack

CALIBRATION

Type 4231	Sound Calibrator (fits in KE-0440)
Type 4226	Multifunction Acoustic Calibrator
Type 4228	Pistonphone
Type 4294	Calibration Exciter
Type 4194-002	Calibration Exciter for Type 8344

MEASURING

Type 3535-A	All-weather Case (see Product Data BP 2251)
Type 4964	Low Frequency Microphone
Type 8344	Low Level Accelerometer
AO-0440-D-015	Signal Cable, LEMO to BNC Male, 1.5 m (5 ft)
AO-0646	Sound Cable, LEMO to Minijack, 1.5 m (5 ft)
AO-0697-D-030	Microphone Extension Cable, 10-pin LEMO, 3 m (10 ft)
AO-0697-D-100	Microphone Extension Cable, 10-pin LEMO, 10 m (33 ft)
AO-0701-D-030	Accelerometer Cable, LEMO to M3, 3 m (10 ft)
AO-0702-D-030	Accelerometer Cable, LEMO to 10 – 32 UNF, 3 m (10 ft)
AO-0722-D-050	Accelerometer cable, LEMO to MIL-C-5015, 5 m (16 ft)
AO-0726-D-030	Signal Cable, LEMO to SMB (for Tacho Probe MM-0360), 3 m (10 ft)
AO-0727-D-010	Signal Cable, LEMO to BNC Female, 1 m (3.3 ft)
AO-0727-D-015	Signal cable, LEMO to BNC Female, 1.5 m (5 ft)
JP-1041	Dual 10-pole Adaptor
UA-0587	Tripod
UA-0801	Small Tripod
UA-1317	Microphone Holder
UA-1404	Outdoor Microphone Kit
UA-1672	AutoDetect Insert for UA-1650
UC-0211	Low Frequency Adaptor
UL-1009	SD Memory Card for Hand-held Analyzers
UL-1013	CF Memory Card for Hand-held Analyzers, for hardware versions 1 – 3
UL-1017	SDHC Memory Card for Hand-held Analyzers

MEASURING WITH REVERBERATION TIME SOFTWARE BZ-7227

Type 2734-A	Power Amplifier*
Type 2734-B	Power Amplifier with built-in UL-0256 Wireless Audio System*
UL-0256	Wireless Audio System*
Type 4292-L	OmniPower Sound Source*
KE-0449	Flight Case for Type 4292-L*
KE-0364	Tripod Carrying Case for Type 4292-L
Type 4224	Sound Source*
Type 4295	Omnidirectional Sound Source*
KE-0392	Carrying Case for Type 4295*
AO-0523-D-100	Cable from Type 2250/2270 to Power Amplifier, 10 m (33 ft.)
AO-0524-D-100	Cable from Type 2250/2270 to Type 4224, 10 m (33 ft.)
AQ-0673	Cable from Power Amplifier to sound source, 10 m (33 ft.)
UA-1476	Wireless Remote Control*

POST-PROCESSING

Type 7831	Qualifier Light
Type 7830	Qualifier

INTERFACING

BZ-5503-A	Logging Module (see Product Data BP 2430)
BZ-5503-B	Spectrum Module (see Product Data BP 2430)
BZ-5503-C	WAV File Analysis Module (see Product Data BP 2430)
Type 7820	Evaluator – data viewing and calculation software
Type 7825	Protector – software for calculation of Personal Noise Exposure
UL-1016	10/100 Ethernet CF Card for hardware versions 1 – 3
UL-1019	CF WLAN Card for Hand-held Analyzers for hardware versions 1 – 3
UL-0250	USB to RS−232 Converter for hardware version 4
UL-1025	SD WLAN Card for Hand-held Analyzers for hardware version 4

*. For sound source systems and components, please see Product Data BP 1689 or BP 0066.

Service Products

MAINTENANCE

2250-UPG	Upgrade of software applications to latest version
2250-EW1	Extended Warranty, one year extension
2250-MW1	5-year Warranty, including yearly Accredited Calibration (annual payment)
2250-MW5	5-year Warranty, including yearly Accredited Calibration
2270-UPG	Upgrade of software applications to latest version
2270-EW1	Extended Warranty, one year extension
2270-MW1	5-year Warranty, including yearly Accredited Calibration (annual payment)
2270-MW5	5-year Warranty, including yearly Accredited Calibration

ACCREDITED CALIBRATION

2250 CAI	Accredited Initial Calibration of Type 2250
2250 CAF	Accredited Calibration of Type 2250
2250 CTF	Traceable Calibration of Type 2250
2250 TCF	Conformance Test of Type 2250, with certificate
2270 CAI	Accredited Initial Calibration of Type 2270
2270 CAF	Accredited Calibration of Type 2270
2270 CTF	Traceable Calibration of Type 2270
2270 TCF	Conformance Test of Type 2270, with certificate

Compliance with Standards

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
Safety	EN/IEC 61010– 1, ANSI/UL 61010– 1 and CSA C22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards **Note:** The above is only guaranteed using accessories listed in this Product Data
EMC Immunity	EN/IEC 61000–6–2: Generic standard – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards **Note:** The above is only guaranteed using accessories listed in this Product Data
Temperature	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: -10 to +50°C (14 to 122°F) Storage Temperature: -25 to +70°C (-13 to 158°F)
Humidity	IEC 60068-2-78: Damp Heat: 93% RH (non-condensing at +40°C (104°F)). Recovery time 2 ~ 4 hours
Mechanical	Non-operating: IEC 60068-2-6: Vibration: 0.3 mm, 20 m/s2, 10 - 500 Hz IEC 60068-2-27: Bump: 1000 bumps at 400 m/s2 IEC 60068-2-27: Shock: 1000 m/s2, 6 directions
Enclosure	IEC 60529 (1989): Protection provided by enclosures: IP20

Appendix A

Setup Parameters

This appendix describes all the setup parameters included in a template.

For 2-channel setup, some parameters are doubled – one for Ch.1 and one for Ch.2 (2270 only)

A.1 Input

Table A.1 *Input parameters*

Parameter	Values	Comment
Input Channel	*Ch. 1* *Ch. 2*	Determines whether Input Ch. 1 or Input Ch. 2 is used for the measurement. (Available in Type 2270 1-channel templates only)
Loudness[*]	*Free-field* *Diffuse-field* *Auto*	Determines whether Loudness and Loudness Level are calculated based on *Free-field* or *Diffuse-field* conditions. Set to *Auto* to follow the setting of Sound Field Correction. For an unknown microphone type, you can set Loudness to the condition matching your request. Available for microphone input only.
Trigger Input[†]	*None* *MATRON Handswitch* *Voltage Level* *Voltage for Monitoring*	This parameter should be set to match the equipment connected to the Trigger Input socket on the connector panel of the analyzer. Set it to *None*, if not used. Set *Trigger Input* to *MATRON Handswitch* if the analyzer is being used in the MATRON system. This setting should also be used if you want to use the Handswitch ZH-0680 for manually triggering signal recordings. **Note:** This can only be used together with analyzers with serial numbers above 2479652 Set *Trigger Input* to *Voltage Level* if you want to control signal recording by a voltage level generated by external equipment. The Voltage Level should generate at least 2 V for On and less than 1 V for Off. The duration of the steady level should be at least 1 s, so it can be recognised by the analyzer Set *Trigger Input* to *Voltage for Monitoring* if you want to monitor the voltage at this input. This setting can be used together with Notifications – see section 8.4. This setting cannot be combined with *MATRON Handswitch* or *Voltage Level*
Label	*Up to four characters*	Labels for the channels: Leftmost is for Channel 1 (default set to "Ch.1") Rightmost for Channel 2 (default set to "Ch.2"). (Available in 2270 2-channel templates only)

Table A.1 *(Cont.) Input parameters*

Parameter	Values	Comment
Input	*Top Socket* *Rear Socket*	Determines whether the input is taken from the Top socket or the Rear socket ('Input' on connector panel). Connect your transducer to this socket **Note:** Sound Field and Windscreen corrections can be added to both the *Top Socket* and the *Rear Socket* (Input parameters). However, be careful that you do not add a 'double' correction – for instance, if you have recorded the signal from the Output socket on a tape recorder, and later want to re-analyse the recording via the Rear socket. In this case you should set *Microphone Type* to *Unknown* on the *Transducer* menu for the used transducer, when using *Rear Socket* Input
Sound Field Correction	*Free-field* *Diffuse-field*	Select a correction matching the sound field of your measurements, that is, you can make correct measurements in a diffuse-field using a Type 4189 or 4190 free-field microphone, by selecting *Diffuse-field* correction. Even *Free-field* correction of a free-field microphone will enhance the overall frequency response of the system. Generally, ISO requires free-field conditions and ANSI requires diffuse-field conditions. Check your local standards for the setting you require. No correction is made for unknown transducers. Available for Microphone input only.
Windscreen Auto Detect	*On* *Off*	Automatic detection of Windscreen UA-1650 when mounted on Microphone Preamplifier ZC-0032. The preamplifier should be connected to the top socket, if necessary using a microphone extension cable. This parameter is available for microphone types using ZC-0032 only
Windscreen Correction	*None* *UA-1650* *UA-1404*	If *Windscreen Auto Detect* is set to *Off*, you can manually select a windscreen correction suitable for the windscreen in use. Correction is automatically made for the windscreen on Types 4952 and 4184-A. No correction is made for unknown transducers. Available for Microphone input only.
Range Setting	*Low Range* *High Range*	Select *Low Range* or *High Range* for input channels. **Note:** Press the **Manual Event** button to Autorange the setting. *High Range* will select a range with 0 dB gain, which allows the highest possible input. *Low Range* will select a range with 30 dB gain. (available in Type 2270 2-channel templates only)

*. Requires Frequency Analysis Software BZ-7223
†. Not available in Reverberation Time Software BZ-7227

A.2 Frequency Settings

Table A.2 *Frequency Setting parameters*[*]

Parameter	Values	Comment
Low Frequency Option	*Off* *On*	Set to *ON* to enable the *Low Frequency* setting, *Very Low*, and the G and Wm frequency weightings. Requires Low Frequency Option BZ-7234.
Low Frequency[*]	*Normal* *Extended* *Very Low*	Use this parameter to extend the low frequency of the broadband measurements and the frequency analysis. However, be aware that the measurements will be more sensitive to very low frequency noise such as wind noise. *Low Frequency* = *Normal*: Frequency analysis[*]: 1/1-octave: 16 Hz – 16 kHz 1/3-octave: 12.5 Hz – 20 kHz *Low Frequency* = *Extended*: Frequency analysis[†]: 1/1-octave: 8 Hz – 16 kHz 1/3-octave: 6.3 Hz – 20 kHz *Low Frequency* = *Very Low*: Frequency analysis[*]: 1/1-octave: 1 Hz – 16 kHz 1/3-octave: 0.8 Hz – 20 kHz (Requires Low Frequency Option BZ-7234) For microphone input this setting is only possible for microphone Types 4193 and 4964 including Low Frequency Adaptor UC-0211.
Broadband (excl. Peak)	Microphone: *A,Z* *A,C* *B,Z* *B,C* *A,G* Accelerometer*:* *Linear* *Linear, Wm* *Linear, Wmb* Direct: *Linear*	All broadband parameters (except L_{peak}) are measured simultaneously with two different frequency weightings – select the weightings here The settings *G*, *Wm* and *Wmb* are available for *Low Frequency* = *Extended* or *Very Low* Requires Low Frequency Option BZ-7234

Table A.2 *(Cont.) Frequency Setting parameters*[*]

Parameter	Values	Comment
Broadband Peak	Microphone: *X* *C* *Z* *G* Accelerometer*:* *Linear* *Linear, Wm* *Linear, Wmb* Direct: *Linear*	One broadband peak parameter L_{peak} is measured, select the frequency weighting here. **Note:** *X* = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ*. 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ* The settings *G*, *Wm* and *Wmb* are available for *Low Frequency* = *Extended* or *Very Low* Requires Low Frequency Option BZ-7234
Spectrum[†]	Microphone: *X* *C* *Z* *G* Accelerometer*:* *Linear* *Linear, Wm* *Linear, Wmb* Direct: *Linear*	The frequency analysis (1/1-octave or 1/3-octave) will be frequency weighted in accordance with this parameter **Note:** *X* = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ*. 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ* The settings *G*, *Wm* and *Wmb* are available for *Low Frequency* = *Extended* or *Very Low* Requires Low Frequency Option BZ-7234
Bandwidth[‡]	*1/1-octave* *1/3-octave*	Bandwidth of frequency analysis
Bottom F. for Special Leq[**,††]	*0.8 Hz* to *Top Frequency*	1/1-octave: 1 Hz – 16 kHz 1/3-octave: 0.8 Hz – 20 kHz **Note:** The lower limit of the parameter depends on *Low Frequency*
Top Freq. for Special Leq[†,‡‡]	*Bottom Frequency* to *20 kHz*	1/1-octave: 1 Hz – 16 kHz 1/3-octave: 0.8 Hz – 20 kHz

*. Not available in Reverberation Time Software BZ 7227.
†. Requires Frequency Analysis Software BZ-7223.
‡. Requires Frequency Analysis Software BZ-7223 or Reverberation Time Software BZ-7227.
**. For BZ-7223, BZ-7224 and BZ-7225 only.
††. *Bottom F. for Special Leq* is f1 in the parameter LXeq(f1-f2)
‡‡. *Top F. for Special Leq* is f2 in the parameter LXeq(f1-f2)

A.3 Statistics

Table A.3 *Statistics parameters (available for microphone input only)**

Parameter	Values	Comment
Broadband Statistics based on	L_{Xeq} L_{XF} L_{XS}	The broadband statistics are based on sampling the broadband parameter L_{XF} or L_{XS} each 10 ms or L_{Xeq} each second. **Note:** *X* = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ*
Spectral Statistics based on†	*LXF* *LXS*	The statistics are based on sampling the instantaneous spectrum every 100 ms (200 ms for *Low Frequency* set to *On*). The time weighting for the spectrum is either F or S. The frequency weighting X is determined by the *Frequency Weighting*, *Spectrum* parameter
Percentile N1	*0.1* to *99.9*	User-defined percentile level where the value of L_{XN1} is exceeded for N1% of the elapsed time
Percentile N2	*0.1* to *99.9*	User-defined percentile level where the value of L_{XN2} is exceeded for N2% of the elapsed time
Percentile N3	*0.1* to *99.9*	User-defined percentile level where the value of L_{XN3} is exceeded for N3% of the elapsed time
Percentile N4	*0.1* to *99.9*	User-defined percentile level where the value of L_{XN4} is exceeded for N4% of the elapsed time
Percentile N5	*0.1* to *99.9*	User-defined percentile level where the value of L_{XN5} is exceeded for N5% of the elapsed time
Percentile N6	*0.1* to *99.9*	User-defined percentile level where the value of L_{XN6} is exceeded for N6% of the elapsed time
Percentile N7	*0.1* to *99.9*	User-defined percentile level where the value of L_{XN7} is exceeded for N7% of the elapsed time

*. Not available for Reverberation Time Software BZ-7227.
†. Requires Frequency Analysis Software BZ-7223.

The *Percentile* levels *N1* to *N7* are common to broadband and spectral statistics, and can be changed after the measurement has been done.

A.4 Measurement Control – for BZ-7222 to BZ-7225

Table A.4 *Measurement Control parameters – for BZ-7222 to BZ-7225*

Parameter	Values	Comment
Measurement Mode *	*Manual* *Automatic*	Determines whether the measurement is under *Manual* control (fully controlled by the **Reset** and **Start/Pause** pushbuttons), or *Automatic* control (start of measurement controlled by the **Reset** and **Start/Pause** pushbuttons, end of measurement automatically controlled by the analyzer when preset time has elapsed)
Preset Time *	*00:00:01* to *24:00:00*	Fixes the duration of a measurement from start to automatic stop (in hours, minutes and seconds). Any pauses made during the measurement via the **Start/Pause** pushbutton are not counted in the preset time
Save Project Data at †	*00:00:00* to *23:59:59*	Determines the time for automatic save of the project and start of a new project
Continuous Logging †	*On* *Off*	Determines whether the logging will run continuously, or for a time set by *Preset Logging Time*
Preset Logging Time ‡	*0.00:00:01* to *31.00:00:00*	Fixes the duration of a measurement from start to automatic stop (in days, hours, minutes and seconds)
Logging Period ‡	*00:00:01* to *24:00:00*	Sets the period of the logging (in hours, minutes and seconds)
Report Period †	*00:01:00 to 24:00:00*	Sets the period of the reports (in hours and minutes)
Full Spectral Stat. for Reports †	*Yes* *No*	Determines whether the full spectral statistics are logged in the report or not. Available for microphone input only.
Synchronize with Clock ‡	*Yes* *No*	Select *Yes* to synchronise the logging and reporting intervals with whole minutes or hours, for example, if *Logging Period* is set to *00:01:00* (1 minute) and *Report Period* is set to *01:00:00* and you start the measurement at 8:12:33, then the first logging interval will be from 8:12:33 to 8:12:59 (27 seconds), the second will be from 8:13:00 to 8:13:59 (60 seconds), etc., and the first Report interval will be from 8:12:33 to 8:59:59 (48 min and 27 seconds), the second will be from 9:00:00 to 9:59:59 (1 hour), etc. Select *No* if you want every logging and reporting interval to be exactly the specified *Logging Period*

Table A.4 *(Cont.) Measurement Control parameters – for BZ-7222 to BZ-7225*

Parameter	Values	Comment
T for LXeq,T,mov	*00:01:00* to *01:00:00*	Sets the averaging time T (in minutes) of the moving L_{Aeq} and moving L_{Ceq}. When the averaging time T has elapsed the $L_{Aeq,T,mov}$ and $L_{Ceq,T,mov}$ parameters will contain the L_{Aeq} and L_{Ceq} of the latest T minutes – updated every second. in addition, you also have $\Delta L_{eq,T,mov} = L_{Ceq,T,mov} - L_{Aeq,T,mov}$. The $L_{Xeq,T,mov}$ is not stored with the total data, but can be logged (BZ-7224 and BZ-7225). The $L_{Aeq,T,mov,max}$, $L_{Ceq,T,mov,max}$ and the difference between the C- and A-weighted values for the complete measurement period are stored. **Note:** There are two sets of these parameters, allowing two simultaneous moving averages: e.g., one with 15 min averaging time and one with 1 hour averaging time.
Charge Injection Calibration ‡	*On* *Off*	Set to *On* for making a CIC at the start and end of Logging. An Exclude marker is set on the profile and *Total* parameters are not updated during the CIC. Available for microphone input only.
Daily CIC †	*None* *Once* *Twice* *Three times* *Four times*	Determines whether a *Charge Injection Calibration* is performed one to four times a day or not at all. An Exclude marker is set on the profile and *Periodic Reports* and *Total* parameters are not updated during the calibration. The results are saved together with the *Total* parameters. Available for microphone input only.
First Check †	*00:00:00* to *23:59:59*	Set time of day for first CIC check **Note:** The *Check* times must be separated from each other by at least one minute. They should also differ by at least one minute from the time set in the *Save Project Data at* parameter. Available for microphone input only.
Second Check †	*00:00:00* to *23:59:59*	Set time of day for second CIC check. Available for microphone input only.
Third Check †	*00:00:00* to *23:59:59*	Set time of day for third CIC check. Available for microphone input only.
Fourth Check †	*00:00:00* to *23:59:59*	Set time of day for fourth CIC check. Available for microphone input only.

*. For Sound Level Meter (BZ-7222) and Frequency Analyzer (BZ-7223) templates only.
†. For Enhanced Logging (BZ-7225) templates only.
‡. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.

A.5 Measurement Control – for Reverberation Time Software BZ-7227

Table A.5 *Measurement Control parameters – for Reverberation Time Software BZ-7227*

Parameter	Values	Comment
Map Based Measurement	*No* *Yes*	If *Map Based Measurement* = *Yes* you can define the source positions and receiver positions graphically on a map – otherwise the measurements are just numbered from position number one (*Pos. 1*) onwards
Meas. All Pos. for Each Source	*No* *Yes*	Parameter only available if *Map Based Measurement* = *Yes.* Set to *Yes* for measuring all positions for each source position. Set to *No* for measuring a specific number of receiver positions per source position
No. of Positions per Source	*1* to *10*	Parameter only available if *Meas. All Pos. for Each Source* = *No* Set number of receiver positions you want to measure per source
Increment	*Sources First* *Receivers First* *Manual*	Parameter only available if *Map Based Measurement* = *Yes.* Allows you to select the quickest method of measurement, when positioning your analyzer in relation to source and receiver positions. (Typically, *Sources First* is best for Impulsive Excitation and *Receivers First* is best for Interrupted Noise excitation)
Automatic Save	*No* *Yes*	Set to *Yes* to automatically save the decay after each measurement
Max. Decay Time	*1* to *30 s*	Sets the maximum duration of the decay measurement. If the decay finishes in a shorter time, decay measurement stops automatically **Note:** If you set *Max. Decay Time* above 20 s, then the measurement will not stop before this time has elapsed

Table A.5 *(Cont.) Measurement Control parameters – for Reverberation Time Software BZ-7227*

Parameter	Values	Comment
Excitation	*Impulsive* *Interrupted Noise*	Select *Impulsive* to excite the room with an impulse. The analyzer triggers on the impulse, measures the impulse as a sequence of spectra with 5 ms intervals, and finally backwardly integrates the measurements to decay curves. Select *Interrupted Noise* to excite the room with noise, interrupt the noise and measure the decays – all controlled by the analyzer
Number of Decays	*1* to *99*	Parameter only available if *Excitation* = *Interrupted Noise.* Specify the number of decays to be measured automatically and averaged together per position
Trigger Level	*0* to *200 dB*	Parameter only available if *Excitation* = *Impulsive.* Specify the trigger level for the sound level in any frequency band – the measurement starts as soon as this level is exceeded. The measurement has a pre-trigger of 1 s
Trigger Repeat	*Off* *On*	Set to *On* to start a new measurement automatically, after saving the previous measurement (and after fulfilling the trigger conditions). Parameter only available if *Excitation* = *Impulsive* and *Automatic Save* = *Yes*
Measurement Mode	*Parallel* *Serial* *Combined*	*Parallel* measures all bands in the spectrum simultaneously, *Serial* measures selected bands, and *Combined* first measures Parallel and then Serial in an automated sequence

A.6 Logged Broadband (100 ms)

Table A.6 *Logged Broadband (100 ms) parameters**

Parameter	Values	Comment
Single channel: *Parameter 1* to *Parameter 3* 2-channel templates (2270 only): *Parameter 1* to *Parameter 4*	Microphone: *LAeq,* *LAF,* *LAS,* *Off* Accelerometer or Direct: *Linear,* *Fast Inst,* *Slow Inst,* *Off*	The selected parameter(s) will be logged every 100 ms. *LAeq* or *Linear* will have an averaging time of 100 ms.

*. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.

A.7 Logged Broadband

Table A.7 *Logged Broadband parameters**

Parameter	Values	Comment
Full Statistics	*Yes* *No*	Determines whether the full broadband statistics are logged or not Available for microphone input only
Broadband Parameters	*All* *Selected*	Determines whether *All* broadband parameters are logged or a *Selected* part is logged (up to 10 parameters for microphone input, otherwise up to 5 parameters)

Table A.7 *(Cont.) Logged Broadband parameters**

Parameter	Values	Comment
Parameter 1 to Parameter 10	Microphone: L_{Xeq} L_{Yeq} L_{Ceq}–L_{Aeq} $L_{Aeq,T1,mov}$ $L_{Aeq,T2,mov}$ $LC_{eq,T1,mov}$ $LC_{eq,T2,mov}$ $\Delta L_{eq,T1,mov}$ $\Delta L_{eq,T2,mov}$ L_{Geq} L_{G10max} L_{G10min} L_{XE} L_{YE} L_{Vpeak} L_{XFmax} L_{XSmax} L_{XImax} L_{YFmax} L_{YSmax} L_{YImax} L_{XFmin} L_{XSmin} L_{XImin} L_{YFmin} L_{YSmin} L_{YImin} L_{XIeq} L_{YIeq} L_{AIeq}–L_{Aeq} L_{AFTeq} L_{AFTeq}–L_{Aeq} L_{avUQ} *SIL* *PSIL* *SIL3* L_{Weq}*(f1-f2)* *Overload* *Trig. Input Voltage* *Wind Dir. avg.* *Wind Dir. min.* *Wind Dir. max.* *Wind Speed avg.* *Wind Speed min.* *Wind Speed max.* *(Values continue on next page)*	This parameter can be set if *Broadband Parameters* = *Selected* *X* = frequency weightings A or B (controlled by *Setup* > *Frequency Settings* > *BB (ex. peak)* parameter) *Y* = frequency weightings C or Z (controlled by *Setup* > *Frequency Settings* > *BB (ex. peak)* parameter) *V* = frequency weightings A, B, C or Z (controlled by *Setup* > *Frequency Settings* > *BB Peak* parameter) *U* = time weightings F or S (controlled by *Setup* > *Occupational Health* > *Time Weighting for Lav* parameter) *Q* = exchange rate 4, 5 or 6 dB (controlled by *Setup* > *Occupational Health* > *Exchange Rate for Lav* parameter) *W* = frequency weightings A, B, C or Z (controlled by *Setup* > *Frequency Settings* > *Spectrum* parameter) *f1* = Bottom frequency band (controlled by *Setup* > *Frequency Settings* > *Bottom F. for Special Leq* parameter) *f2* = Top frequency band (controlled by *Setup* > *Frequency Settings* > *Top Freq. for Special Leq* parameter) **Note:** The parameter values shown are for single-channel templates. For 2-channel templates (Type 2270 only) most of the values are available for both Ch.1 and Ch.2

Table A.7 *(Cont.) Logged Broadband parameters**

Parameter	Values	Comment
(Cont.) Parameter 1 to Parameter 10	*Amb. Temperature* *Amb. Humidity* *Amb. Pressure* *Amb. Rain Gauge* Accelerometer: *Linear* *Peak* *Fast max* *Slow max* *Fast min* *Slow min* *Linear(f1-f2)* *Overload* *Trig. Input Voltage* *aW/LW* *aWCrest* *MTVV* *KBFmax* *KBFTm* *PeakW* Linear: *Peak* *Fast max* *Slow max* *Fast min* *Slow min* *Linear(f1-f2)* *Overload* *Trig. Input Voltage*	

*. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.

A.8 Logged Spectrum

Table A.8 *Logged Spectrum parameters**

Parameter	Values	Comment
Full Spectral Statistics	*Yes* *No*	Determines whether the full spectral statistics are logged or not
Spectrum Parameters	*All* *Selected* *None*	Determines whether *All* spectrum parameters are logged, a *Selected* part of the parameters are logged (up to 3 parameters) or *None* are logged

Table A.8 *(Cont.) Logged Spectrum parameters**

Parameter	Values	Comment
Spectrum 1 to Spectrum 3	Microphone: L_{Xeq} L_{XFmax} L_{XSmax} L_{XFmin} L_{XSmin} *Off* Accelerometer*:* *Linear / aW* *Fast max* *Slow max* *Fast min* *Slow min* *Off* Direct: *Linear* *Fast max* *Slow max* *Fast min* *Slow min* *Off*	These parameters can be set if S*pectrum Parameters* = *Selected* *X* = frequency weightings A, B, C, Z or G (controlled by *Setup* > *Frequency Settings* > *Spectrum* parameter) **Note:** The parameter values shown are for single-channel templates. For 2-channel templates (Type 2270 only) the values are available for both Ch.1 and Ch.2

*. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only, requires Frequency Analysis Software BZ-7223.

A.9 Markers

Table A.9 *Markers**

Parameter	Values	Comment
Marker 1	*Text string*	Default set to ‘Exclude’. This marker can be set using the stylus in the profile or the **Back-erase** pushbutton during a measurement
Marker 2	*Text string*	Default set to ‘Manual’. This marker can be set using the stylus in the profile or the **Manual Event** pushbutton during a measurement
Marker 3	*Text string*	Default set to ‘Level’. This marker can be set using the stylus in the profile, or if the conditions for the Level Trigger are met during a measurement
Marker 4 and Marker 5	*Text string*	These markers can be set using the stylus in the profile display

Table A.9 *(Cont.) Markers**

Parameter	Values	Comment
Marker 6	*Text string*	Default set to 'Sound'. This marker is set if a signal recording is made during a measurement
Pre-marker Time	*0* to *5 s*	Specifies number of seconds marker 1, marker 2 or marker 3 will be set ahead of the point where the **Back-erase** or the **Manual Event** pushbuttons are pressed or the level trigger conditions are fulfilled

*. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.

A.10 Level Trigger

Table A.10 *Level Trigger parameters**

Parameter	Values	Comment
Level Trigger Control	*On* *Off*	Set to *On* for setting Marker 3 (Level) when the *Trigger Parameter* fulfils the Level Trigger conditions (see below). The conditions are checked every second. Signal Recording† can also be controlled by these settings, see *Setup > Signal Recording > Recording Control* parameter
Start Slope	*Rising* *Falling*	Set to *Rising* to start when level goes above *Start Level* (and then stop when level goes below *Stop Level*). Set to *Falling* to start when level goes below *Start Level* (and stop when level goes above *Stop Level*)
Start Level	*–100* to *200 dB*	Start trigger conditions are fulfilled, when level crosses *Start Level* (in accordance with *Start Slope*) for at least *Start Duration* seconds – set *Start Level here*
Start Duration	*0* to *420 s*	Start trigger conditions are fulfilled, when level crosses *Start Level* (in accordance with *Start Slope*) for at least *Start Duration* seconds – set *Start Duration here*. The *Start Duration* will be limited by the internal recording buffer size and the *Recording Quality* and *Resolution* (Table A.18).

Table A.10 *(Cont.) Level Trigger parameters**

Parameter	Values	Comment
Stop Level	*–100* to *200 dB*	Stop trigger conditions are fulfilled, when level crosses *Stop Level* (in accordance with *Start Slope*) for at least *Stop Duration* seconds – set *Stop Level here*
Stop Duration	*0* to *420 s*	Stop trigger conditions are fulfilled, when level crosses *Stop Level* (in accordance with *Start Slope*) for at least *Stop Duration* seconds – set *Stop Duration here*
Trigger Parameter	Microphone: L_{Xeq} L_{Yeq} $L_{Aeq,T1,mov}$ $L_{Aeq,T2,mov}$ $L_{Ceq,T1,mov}$ $L_{Ceq,T2,mov}$ L_{Geq} L_{G10max} L_{G10min} L_{Vpeak} L_{XFmax} L_{XSmax} L_{XImax} L_{YFmax} L_{YSmax} L_{YImax} L_{XFmin} L_{XSmin} L_{XImin} L_{YFmin} L_{YSmin} L_{YImin} $L_{XF(SPL)}$ $L_{XS(SPL)}$ $L_{XI(SPL)}$ $L_{YF(SPL)}$ $L_{YS(SPL)}$ $L_{YI(SPL)}$ *(Values continue on next page)*	Select which parameter to monitor for the level trigger. The parameter is based on 1 second measurements and checked every second regardless of the logging period and logged parameters *X* = frequency weightings A or B (controlled by *Setup* > *Frequency Settings* > *BB (ex. peak)* parameter). *Y* = frequency weightings C or Z (controlled by *Setup* > *Frequency Settings* > *BB (ex. peak)* parameter). *V* = frequency weightings A, B, C or Z (controlled by *Setup* > *Frequency Settings* > *BB Peak parameter*) **Note:** The parameter values shown are for single-channel templates. For 2-channel templates (Type 2270 only) the values are available for both Ch.1 and Ch.2

Table A.10 *(Cont.) Level Trigger parameters**

Parameter	Values	Comment
(Cont.) Trigger Parameter	Accelerometer: *Linear* *Peak* *Fast max* *Slow max* *Fast min* *Slow min* *aW/LW* *KBFmax* *PeakW* Direct: *Linear* *Peak* *Fast max* *Slow max* *Fast min* *Slow min*	

*. For Logging (BZ-7224) templates only.
†. Requires license for Signal Recording BZ-7226.

A.11 Triggers

Table A.11 *Trigger parameters**

Parameter	Values	Comment
Signal Recording Timer		
Timer	*On* *Off*	Set to *On* to periodically generate a *Timer Event.* **Note:** Set *Signal Recording*, *Recording Control* to *Timer Event* or *All Events*
Timer Period	*00:01:00* to *48:00:00*	The signal recording is triggered with *Timer Period* intervals
Synchronize with Clock	*Yes* *No*	Select *Yes* to synch. the start of signal recordings with whole minutes or hours. Select *No* if you want the first signal recording Timer Period after start
Duration	*00:00:01* to *24:00:00*	Specifies the duration of the timer for the signal recording. **Note:** The total time of the signal recording will be Pre-recording Time + Duration + Post-recording Time

Table A.11 *(Cont.) Trigger parameters*[*]

Parameter	Values	Comment
Level Trigger 1[†‡]		
Trigger	*On* *Off*	Set to *On* for setting Marker 3 (Level) when the *Trigger Parameter* fulfils the Level Trigger conditions (see below). The conditions are checked every second. Signal Recordings[C] can also be controlled by these settings, see *Setup > Signal Recording > Recording Control*
Start Time	*00:00:00* to *23:59:59*	*Start Time* defines when the level trigger is enabled. Triggering is limited to the enabled time
Stop Time	*00:00:00* to *23:59:59*	*Stop Time* defines when the level trigger is disabled. Triggering is limited to the enabled time
Hold Off	*00:00:00* to *01:00:00*	*Hold Off* specifies a time after a level trigger, where level triggering is disabled. Can be useful in reducing the number of triggers
Start Slope	*Rising* *Falling*	Set to *Rising* to start when level goes above *Start Level* (and then stop when level goes below *Stop Level*). Set to *Falling* to start when level goes below *Start Level* (and stop when level goes above *Stop Level*)
Start Level	*–100* to *200 dB*	Start trigger conditions are fulfilled when level crosses *Start Level* (in accordance with *Start Slope*) for at least *Start Duration* seconds – set *Start Level here*
Start Duration	*0* to *420 s*	Start trigger conditions are fulfilled when level crosses *Start Level* (in accordance with *Start Slope*) for at least *Start Duration* seconds – set *Start Duration here.* The *Start Duration* will be limited by the internal recording buffer size and the *Recording Quality* and *Resolution* (Table A.18)
Stop Level	*–100* to *200 dB*	Stop trigger conditions are fulfilled when level crosses *Stop Level* (in accordance with *Start Slope*) for at least *Stop Duration* seconds – set *Stop Level here*

Table A.11 *(Cont.) Trigger parameters**

Parameter	Values	Comment
Stop Duration	*0* to *420 s*	Stop trigger conditions are fulfilled when level crosses *Stop Level* (in accordance with *Start Slope*) for at least *Stop Duration* seconds – set *Stop Duration here. The Stop Duration will be limited by the internal recording buffer size and the Recording Quality* and *Resolution* (Table A.18)
Trigger Parameter	Microphone: L_{Xeq} L_{Yeq} $L_{Aeq,T1,mov}$ $L_{Aeq,T2,mov}$ $L_{Ceq,T1,mov}$ $L_{Ceq,T2,mov}$ L_{Geq} L_{G10max} L_{G10min} L_{Vpeak} L_{XFmax} L_{XSmax} L_{XImax} L_{YFmax} L_{YSmax} L_{YImax} L_{XFmin} L_{XSmin} L_{XImin} L_{YFmin} L_{YSmin} L_{YImin} $L_{XF(SPL)}$ $L_{XS(SPL)}$ $L_{XI(SPL)}$ $L_{YF(SPL)}$ $L_{YS(SPL)}$ $L_{YI(SPL}$ L_{Weq}*(f1-f2)* *(Values continue on next page)*	Select which parameter to monitor for the level trigger. The parameter is based on 1 second measurements and checked every second regardless of the logging period and logged parameters *X* = frequency weightings A or B (controlled by *Setup* > *Frequency Settings* > *BB (ex. peak)* parameter) *Y* = frequency weightings C or Z (controlled by *Setup* > *Frequency Settings* > *BB (ex. peak)* parameter) *V* = frequency weightings A, B, C or Z (controlled by *Setup* > *Frequency Settings* > *BB Peak* parameter) *W* = frequency weightings A, B, C or Z (controlled by*Setup* > *Frequency Settings* > *Spectrum* parameter) *(Comments continue on next page)*

Table A.11 *(Cont.) Trigger parameters**

Parameter	Values	Comment
(Cont.) Trigger Parameter	Accelerometer: *Linear* *Peak* *Fast max* *Slow max* *Fast min* *Slow min* *Linear(F1-F2)* *aW / LW* *KBFmax* *PeakW* Direct: *Linear* *Peak* *Fast max* *Slow max* *Fast min* *Slow min* *Linear(F1-F2)*	*f1* = Lower freq. range (controlled by *Setup > Frequency Settings > Bottom F. for Special Leq* parameter) *f2* = Upper freq. range (controlled by *Setup > Frequency Settings > Top Freq. for Special Leq* parameter) **Note:** The parameter values shown are for single-channel templates. For 2-channel templates (Type 2270 only) the values are available for both Ch.1 and Ch.2
Level Trigger 2: Exactly the same parameters as Level Trigger 1		
Level Trigger 3: Exactly the same parameters as Level Trigger 1		
Level Trigger 4: Exactly the same parameters as Level Trigger 1		

*. For Enhanced Logging (BZ-7225) templates only.
†. Up to four individual trigger settings can be set for non-overlapping time periods of the day.
‡. Requires license for Signal Recording BZ-7226.

A.12 Units

Table A.12 *Unit parameters (available for Accelerometer or Direct input only)*

Parameter	Values	Comment
Engineering Unit	*No*	Select *No* to display values in dB
	Yes	Select *Yes* to display values in m/s^2 (Accelerometer input) or V (Direct input) **Note:** Use *Preferences > Regional Settings* to select whether the *Vibration* unit should be m/s^2 (SI) or g (US/UK)

A.13 Signal Recording

Table A.13 *Signal Recording parameters*[*]

Parameter	Values	Comment
Recording Control	*Off* *Automatic* *Manual Event* *Exclude Event*[†] *External Event* *Level Trigger Event*[†] *Timer Event*[‡] *All Events*[†] *Image Event*	Determines how recording of the measured signal is controlled Set to *Automatic* to start the recording when the measurement is started and record throughout the measurement, only limited by the *Maximum Duration* Set to *Manual Event* to start recording manually while measuring when the **Manual Event** pushbutton is pressed, and record until pressing the pushbutton again, however, take *Maximum* and *Minimum Duration* into account Set to *Exclude Event* to start recording manually while measuring when the **Back-erase** pushbutton is pressed, and record until pressing the pushbutton again, however, take *Maximum* and *Minimum Duration* into account Set to *External Event* to start recording using external equipment connected to the Trigger Input Socket Set to *Level Trigger Event* to record while the level trigger conditions are fulfilled, however, take *Maximum* and *Minimum Duration* into account Set to *Timer Event* (BZ-7225 only) to record while the timer trigger conditions are fulfilled, however, take *Maximum* and *Minimum Duration* into account *(Comments continue on next page)*

Table A.13 *(Cont.) Signal Recording parameters*[*]

Parameter	Values	Comment
(Cont.) Recording Control		Set to *All Events* to record while any of the events above are active, however, take *Maximum* and *Minimum Duration* into account If you do not want to record the input signal, then set *Recording Control* to *Off*, to economise on power Set to *Image Event* (Type 2270 only) to make a recording of 1 s + Pre-recording Time + Post-recording Time **Note:** For Reverberation Time Software BZ-7227, the values are limited to *Off* and *Automatic*. Set to *Automatic* to make signal recordings during the measurements
Recorded Channel	*Ch.1* *Ch.2* *Both*	Select *Ch.1 or Ch.2* to record that channel or select *Both* to record both channels simultaneously.
Recording Quality	*Low* *Fair* *Medium* *High*	This setup determines the quality of the recording by adjusting the sampling rate. The amount of space required for the recording will depend on the selected quality (see details in the Specifications chapter)
Recorded Signal [†]	Microphone: *Input X-weighted* *Input C-weighted* *Input Z-weighted* Accelerometer and Direct: *Input Linear*	Use this parameter to select the frequency weighting of the recorded signal **Note 1:** The frequency weighting of the recorded signal can be selected independently of the frequency weighting of the measurement, the signal at the output socket and the signal at the earphone socket **Note 2:** *X* = frequency weighting A or B. 'A' requires that the *BB (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *BB (excl. Peak)* parameter is set to *BC or BZ* **Note 3:** Recording in 2-channel templates will only record *Input Z-weighted* for Microphone input

Table A.13 *(Cont.) Signal Recording parameters*[*]

Parameter	Values	Comment
Automatic Gain Control [†]	*On* *Off*	To ease identification of sound sources, the gain can be automatically adjusted to keep the average level within a 40 dB range. When playing back the recorded signal, you will then hear clearly the whole signal content, whether the level has been 20 dB or 140 dB. Set *Automatic Gain Control* to *On* to convert the recorded signal. The recorded signal is stored as a 16-bit .WAV file. Set *Automatic Gain Control* to *Off* for recording the signal with a fixed gain – then set *Resolution* = *24 bit* (recommended) to cover the full 120 dB dynamic range (from max. input level and down) or select *Resolution* = *16 bit* and specify the *Peak Recording Level* to fit the signal. **Note:** If the sound contains very high levels at low frequency, then a fixed gain is recommended
Resolution	*24 bit* *16 bit*	Set *Resolution* to *24 bit* to cover the full dynamic range. Set *Resolution* to *16 bit* to cover up to 96 dB from *Peak Recording Level* and down. **Note:** You will only be warned about overload in the recorded signal if *Automatic Gain Control* is *On* or if *Resolution* is *24 bit* or if *Peak Recording Level* is set to its maximum value **Note:** 24-bit recording not possible in BZ-7227
Peak Recording Level	*145 dB* *135 dB* *125 dB* *115 dB* *105 dB* *95 dB* *85 dB* *75 dB*	For *Automatic Gain Control* = *Off* and *Resolution* = *16 bit* the recorded wave file has a dynamic range of up to 96 dB. When playing back on the analyzer, the dynamic range of the output is approx. 75 dB. When playing back on a PC it might be even lower. Set *Peak Recording Level* to fit the signal. The values for *Peak Recording Level* take the sensitivity of the attached transducer into account. The values shown in the list here are nominal values for a Type 4189 or 4190 microphone. **Hint:** Monitor the L_{peak} value during a trial measurement before selecting the *Peak Recording Level* **Note:** For recording in 2-channel templates the *Peak Recording Level* will automatically be set in accordance with the *Input* > *Range Setting* parameter (i.e., *High Range* or *Low Range*)

Table A.13 *(Cont.) Signal Recording parameters*[*]

Parameter	Values	Comment
Pre-recording Time [†]	*0* to *470 s*	Recording is started the *Pre-recording Time* before the trigger conditions are fulfilled (for example, 5 s means the recording will be started 5 s before you hit the **Manual Event** pushbutton). This is possible because the recording is done continuously in an internal buffer, ready to be saved as a wave file. The *Pre-recording Time* is limited by this buffer size and the *Recording Quality* and *Resolution* (see details in the Specifications chapter)
Post-recording Time [†]	*0* to *1:00:00:00*	Use this parameter to specify how much extra you want to be recorded after the trigger conditions are no longer fulfilled
Duration Limit [†]	*On* *Off*	Use this parameter to enable the *Minimum Duration* and *Maximum Duration* parameters for overruling the duration of the signal recording determined by the trigger condition parameters
Minimum Duration [†]	*00:00:00* to *1:00:00:00*	When *Duration Limit* is *On*, then *Minimum Duration* will determine the minimum recording time regardless of the trigger conditions The total record length will then (as a minimum) be the sum of *Minimum Duration*, *Pre-recording Time* and *Post-recording Time*
Maximum Duration [†]	*00:00:00* to *7:00:00:00*	When *Duration Limit* is *On*, then *Maximum Duration* will determine the maximum recording time regardless of the trigger conditions. The total record length will then (as a maximum) be the sum of *Maximum Duration*, *Pre-recording Time* and *Post-recording Time.* **Note:** If *Maximum Duration* = *00:00:00*, then it is disabled and does not limit the duration

*. Requires license for Signal Recording Option BZ-7226.
†. For Logging (BZ-7224) and Enhanced Logging (BZ-7225) templates only.
‡. For Enhanced Logging (BZ-7225) templates only.

A.14 Output Socket Signal

Table A.14 *Output Socket Signal parameters**

Parameter	Values	Comment
Source	Microphone: *Off* *Input X-weighted* *Input C-weighted* *Input Z-weighted* L_{XF} *DC Voltage* *Generator* Accelerometer and Direct: *Off* *Input Linear*	Output to the Output socket on the connector panel. Select between *Off* and the input signal for monitoring purposes. The L_{AF} setting will output the X-weighted sound level as a voltage between 0 V and 4 V. Use the *DC Voltage* parameter to calibrate the connected equipment by setting the *DC Output*. Use *Generator* parameter to output the signal specified by the Generator settings. **Note 1:** If you do not want to output the signal, then select *Off* to economise the power. **Note 2:** *X* = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ.* **Note 3:** The *Generator* setting is only available for Frequency Analysis templates
DC Output (20 mV/dB)	*0.0* to *200.0 dB*	*Source* = *DC Voltage* will output: 0 V for *DC Output* = *0 dB* and 4 V for *DC Output* = *200 dB*
Output Gain Input	*–60.0 dB* to *60.0 dB*	Output gain of the input signal. Key in a gain value (0.1 dB resolution) for the input signal. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/decrement the value in steps of 1 dB. **Note:** 0 dB means 1 V output for 1 V input.

*. Not available for Reverberation Time Software BZ-7227.

A.15 L_{den} Periods

Table A.15 *L_{den} Periods parameters**

Parameter	Values	Comment
Day Start	*00:00:00* to *23:59:59*	Determines the start of the day period for the L_{day} calculation
Evening Start	*00:00:00* to *23:59:59*	Determines the start of the evening period for the $L_{evening}$ calculation
Night Start	*00:00:00* to *23:59:59*	Determines the start of the night period for the L_{night} calculation
Evening Penalty	*0* to *20 dB*	The Evening Penalty will be added to $L_{evening}$ when calculating L_{den}
Night Penalty	*0* to *20 dB*	The Night Penalty will be added to L_{night} when calculating L_{den}

*. For Enhanced Logging (BZ-7225) templates and microphone input only.

Note: If *Evening Start* is set between *Night Start* and *Day Start*, then the $L_{evening}$ parameter will be undefined.

A.16 Occupational Health

Table A.16 *Occupational Health Parameters**

Parameter	Values	Comment
Exposure Time	*00:01:00* to *1.00:00:00*	Set the *Exposure Time* to the actual time that you are exposed to noise during a workday. Used for calculation of $L_{ep,d}$ and $L_{ep,d,v}$. **Note:** *Exposure Time* can be changed after the measurement has been done
Reference Time	*00:01:00* to *5.00:00:00*	Set the *Reference Time* as required for calculation of Sound Exposure Level or Time Weighed Average with a reference time other than 8 hours. Used for calculation of $L_{ep,d,v}$ and TWA_v
Threshold Level	*0* to *140 dB*	Any sound levels below the threshold value do not contribute to the Dose measurement data. The time resolution for this calculation is 1 s for calculation of Dose and ProjDose – and 10 ms for calculation of TWA, TWA_v, DoseUQ and ProjDoseUQ. Used for calculation of Dose, ProjDose, TWA, TWAv, DoseUQ, ProjDoseUQ. *U* = *Time Weighting for Lav*: F or S *Q* = *Exchange Rate for Lav*: 4, 5 or 6 dB

Table A.16 *(Cont.) Occupational Health Parameters**

Parameter	Values	Comment
Criterion Level	*0* to *140 dB*	*Criterion Level* is the sound level allowed for an 8-hour period and would yield a 100% dose. The criterion level must be set according to the legislation with which you will have to comply. Used for calculation of Dose, ProjDose, DoseUQ, ProjDoseUQ. *U* = *Time Weighting for Lav*: F or S *Q* = *Exchange Rate for Lav*: 4, 5 or 6 dB

PeaksOver Level	*0* to *200 dB*	Any peak levels that exceed the level set here will be counted.
		Used for calculation of #XPeaks(>NNNdB)
		X = A, B, C, Z or G, set by *Setup* > *Frequency Settings* > *BB Peak*, NNN is the *PeaksOver Level*
		Note: Two other peak counters are preset to count peaks over 135 dB and 137 dB, respectively

Exchange Rate for Lav	*4 dB* *5 dB* *6 dB*	The increase in noise level that corresponds to a doubling of the noise level is determined by *Exchange Rate for Lav*. Set *Exchange Rate for Lav* as required by your local standards. Used for calculation of LavUQ, TWA, TWA_V DoseUQ, ProjDoseUQ. *U* = *Time Weighting for Lav*: F or S *Q* = *Exchange Rate for Lav*: 4, 5 or 6 dB **Note:** TWA and TWA_V requires *U* = *S* and *Q* = *5*
Time Weighting for Lav	*F* *S*	Lav will be time weighted in accordance with this parameter. Used for calculation of LavUQ, TWA, TWA_V DoseUQ, ProjDoseUQ. *U* = *Time Weighting for Lav*: F or S *Q* = *Exchange Rate for Lav*: 4, 5 or 6 dB **Note:** TWA and TWA_V requires *U* = *S* *and Q* = *5*

*. Not available for Reverberation Time Software BZ-7227.

A.17 Generator

Table A.17 *Generator Parameters**

Parameter	Values	Comment
Generator Type	*Internal* *External*	Set to *Internal* to use the internal noise generator as specified below. Set to *External* to switch an external generator on/off using a logic signal: On = 4.5 V; Off = 0 V. The generator signal appears at the Output Socket. **Note 1:** For Reverberation Time Software BZ-7227, set *Measurement Control*, *Excitation* = *Interrupted Noise* to enable the generator parameters. **Note 2**: For Frequency Analysis Software BZ-7223, set *Output Socket Signal*, *Source* = *Generator* to enable the generator parameters
Noise Type	*Pink* *White*	The type of noise from the internal generator. The bandwidth of the noise will be adjusted to the frequency range from *Bottom Frequency* to *Top Frequency*
Level [re. 1 V]	*–60.0* to *0.0 dB*	This sets the internal noise generator attenuation in dB, referenced to 1 V. This level stays at the set level irrespective of the frequency range
Sound Source	*Unknown* *Type 4292 Optimum* *Type 4295 Optimum* *Type 4296 Optimum* *Type 4292 Flat* *Type 4295 Flat* *Type 4296 Flat*	This setting optimises the frequency response of the internal generator output to the connected sound source. The ‘Flat’ setting optimises the output for a flat power response, the ‘Optimum’ setting optimises the power difference between adjacent 1/1- or 1/3-octave bands, while maintaining a ‘boost’ at low frequencies. Select a type matching your sound source: OmniPower Sound Source Type 4292 or 4296 or OmniSource Sound Source Type 4295. Select *Unknown* if you are using another sound source, or don't want to correct the frequency response
Escape Time	*0* to *60 s*	Set the *Escape Time* to allow the operator to leave the room before the generator is turned on and the measurement starts

Table A.17 *(Cont.) Generator Parameters**

Parameter	Values	Comment
Build-up Time	*1* to *20 s*	Set the *Build-up Time* to allow the sound pressure in the room to settle after the sound source is switched on
Bottom Frequency†	*50 Hz* to *Top Frequency*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz **Note:** The settings of *Bottom* and *Top Frequency* control the bandwidth of the noise from the internal noise generator
Top Frequency†	*Bottom Frequency* to *10 kHz*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz

*. Available for Frequency Analysis Software BZ-7223, single channel, and Reverberation Time Software BZ-7227 and microphone input only.
†. Available for Frequency Analysis Software BZ-7223 only.

A.18 Post-processing

Table A.18 *Post-processing Parameters**

Parameter	Values	Comment
Ensemble Averaging	*No* *Yes*	Set to *Yes* to average each of the position decays into an average decay (called the ensemble average or room average). The averaged decays of the room can then be displayed in the Decay View. T30 Room, T20 Room and EDT Room will be calculated from the room average. Set to *No* for no ensemble averaging. There will be no decays available for the room. T30 Room, T20 Room and EDT Room will be calculated as averages of the T30, T20 and EDT, respectively, for all the positions[b]

Table A.18 *(Cont.) Post-processing Parameters*[*]

Parameter	Values	Comment
Wide Band RT Bottom	*50 Hz to Wide Band* *RT Top*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz The settings of *Wide Band RT Bottom* and *Wide Band RT Top* control the range of frequency bands used in the averaging of the wide band parameters available below the Spectrum and Decay graphs. **Example:** Set *Wide Band RT Bottom* to *100 Hz* and *Top* to *2 kHz*, then the average of the frequency bands from 100 Hz to 2 kHz will be calculated for the current position as: • T30 (100 Hz – 2 kHz) • T20 (100 Hz – 2 kHz) • EDT (100 Hz – 2 kHz) and for the Room as: • T30 Room (100 Hz – 2 kHz) • T20 Room (100 Hz – 2 kHz) • EDT Room (100 Hz – 2 kHz)
Wide Band RT Top	*Wide Band RT Bottom* to *10 kHz*	1/1-octave: 63 Hz – 8 kHz 1/3-octave: 50 Hz – 10 kHz

*. Requires Reverberation Time Software BZ-7227.

A.19 Tone Assessment

Table A.19 *Tone Assessment Parameters**

Parameter	Values	Comment
Tone Assessment	*On* *Off*	Set *Tone Assessment* to *On* to enable tone assessment functionality, then select the *Tone* parameter above the spectrum to display the results
Tone Standard	*ISO 1996:2-2007* *DM 16-03-1998*	Set the *Tone Standard* in accordance with your requirements: **ISO 1996:2-2007, Annex D** is the objective method for assessing the audibility of tones in noise – simplified method. This method uses 1/3-octave spectra **DM 16-03-1998** assesses tone using 1/3-octave spectra according to Italian Law: Ministero dell'Ambiente, Decreto 16 marzo 1998
Adjustment	*0.0* to *20 dB*	This is the adjustment you should add to L_{Aeq} if audible tones are found in the spectrum. The resulting adjustment can be read below the spectrum **Note:** The adjustment is fixed to 5 dB in the DM 16-03-1998 standard
Low Freq. Last Band	*12.5 Hz* to *315 Hz*	Set the frequency for the last band of the low frequency range of the assessment. Default is 125 Hz The low frequency range is from the lowest measured frequency band to the value of the *Low Freq. Last Band* parameter **Note:** Only available if *Tone Standard* parameter is set to *ISO 1996:2-2007*
Middle Freq. Last Band	*160 Hz* to *20 kHz*	Set the frequency for the last band of the middle frequency range of the assessment. Default is 400 Hz The middle frequency range is from one band higher than the *Low Freq. Last Band* parameter to the value of the *Middle Freq. Last Band* parameter **Note:** Only available if *Tone Standard* parameter is set to *ISO 1996:2-2007*

Table A.19 *(Cont.) Tone Assessment Parameters*[*]

Parameter	Values	Comment
Level Difference Low	*0.1* to *100.0 dB*	Set the required level difference for detecting a tone in the low frequency range. Default is 15 dB **Note:** Only available if *Tone Standard* parameter is set to *ISO 1996:2-2007*
Level Difference Middle	*0.1* to *100.0 dB*	Set the required level difference for detecting a tone in the middle frequency range. Default is 8 dB **Note:** Only available if *Tone Standard* parameter is set to *ISO 1996:2-2007*
Level Difference High	*0.1* to *100.0 dB*	Set the required level difference for detecting a tone in the high frequency range. Default is 5 dB **Note:** Only available if *Tone Standard* parameter is set to *ISO 1996:2-2007*
ISO 226	*1987 Free-field* *1987 Diffuse-field* *2003 Free-field*	The tone is checked against levels in other frequency bands using normal equal loudness level contours defined by ISO 226. Select here which version of the standard to use. **Note:** Only available if *Tone Standard* parameter is set to *DM 16-03-1998*

*. Requires Tone Assessment Option BZ-7231. Available for microphone input only.

Appendix B

Measurement Parameters

This appendix describes the measurement parameters. They are measured in accordance with the setup parameters.

- *Please refer to the Glossary in Appendix E for a description of the parameters*
- *The following letters are substituted in the parameters that follow to represent the wide range of frequency weightings, time weightings and percentile levels available:*

V = frequency weightings A, B, C or Z (controlled by *Setup > Frequency Settings > BB Peak* parameter)

X = frequency weightings A or B (controlled by *Setup > Frequency Settings > BB (excl. peak)* parameter)

Y = frequency weightings C or Z (controlled by *Setup > Frequency Settings > BB (excl. peak)* parameter)

W = frequency weightings A, B, C, Z or G (controlled by *Setup > Frequency Settings > Spectrum* parameter)

U = time weightings F or S (controlled by *Setup > Statistics > Spectral Statistics based on* parameter)

R = time weightings F or S (controlled by *Setup > Occupational Health > Time Weighting for Lav* parameter)

Q = exchange rate 4, 5 or 6 dB (controlled by *Setup > Occupational Health > Exchange Rate for Lav* parameter)

N = number between 0.1 and 99.9 (controlled by *Setup > Statistics > Percentile N* parameter)

Note: All parameters will be per channel in 2-channel templates unless stated otherwise (Type 2270 only).

B.1 Total Measurement (Microphone Input)

B.1.1 For Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223, Logging Software BZ-7224 and Enhanced Logging Software BZ-7225

The following parameters are measured within the Elapsed Time:

Equivalent Continuous Sound Levels

- L_{Xeq}
- L_{Yeq}
- $L_{Ceq} - L_{Aeq}$
- $L_{Aeq,T1,mov}$ (not saved with data)
- $L_{Aeq,T1,mov,max}$
- $L_{Aeq,T2,mov}$ (not saved with data)
- $L_{Aeq,T2,mov,max}$
- $L_{Ceq,T1,mov}$ (not saved with data)
- $L_{Ceq,T1,mov,max}$
- $L_{Ceq,T2,mov}$ (not saved with data)
- $L_{Ceq,T2,mov,max}$
- $\Delta L_{eq,T1,mov}$ (not saved with data)
- $\Delta L_{eq,T1,mov,max}$
- $\Delta L_{eq,T2,mov}$ (not saved with data)
- $\Delta L_{eq,T2,mov,max}$

Sound Exposure Level

- L_{XE}
- L_{YE}

Peak Sound Level

- L_{Vpeak}
- T_{Vpeak}

Maximum Time-weighted Sound Levels

- L_{XFmax}
- L_{XSmax}
- L_{XImax}
- L_{YFmax}
- L_{YSmax}
- L_{YImax}

Minimum Time-weighted Sound Levels

- L_{XFmin}
- L_{XSmin}
- L_{XImin}
- L_{YFmin}
- L_{YSmin}
- L_{YImin}

ISO/EU Occupational Health Parameters

- *E*
- *Dose*
- *ProjDose*
- *#VPeaks* (>xxx dB)
- *#VPeaks* (>137 dB)
- *#VPeaks* (>135 dB)

US Occupational Health Parameters

- L_{avRQ}
- *TWA*
- TWA_v
- *DoseRQ*
- *ProjDoseRQ*

General Parameters

- *Overload* in %
- *Start time* (common to both channels in 2-channel templates)
- *Stop Time* (common to both channels in 2-channel templates)
- *Elapsed Time* (excl. pauses; common to both channels in 2-channel templates)

Special Parameters

- L_{XIeq} (also called L_{XIm})
- L_{YIeq}
- $L_{AIeq} - L_{Aeq}$
- L_{AFTeq} (also called L_{AFTm5})
- $L_{AFTeq} - L_{Aeq}$
- *SIL* (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz)*
- *PSIL* (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz and 2000 Hz)*
- *SIL3* (average of L_{Zeq} octave band levels: 1000 Hz, 2000 Hz and 4000 Hz)*
- $L_{Weq}(f1 - f2)$ (sum of power values for L_{Weq} frequency bands from f1 Hz to f2 Hz)*

*. These parameters require license for BZ-7223 and measurement of spectra.

Noise Indicators*

- L_{day}
- $L_{evening}$
- L_{night}
- L_{den}
- L_{dn}

Statistics to Calculate Percentile Levels and Std.Dev.

Low-frequency Parameters (requires Low Frequency Option BZ-7234)

- L_{Geq}
- L_{G10max}
- L_{G10min}
- L_{Gpeak}
- T_{Gpeak}
- *#GPeaks (>xxx dB)*
- *#GPeaks (>137 dB)*
- *#GPeaks (>135 dB)*

Weather Data (requires connection to a weather station; common to both channels in 2-channel templates)

- *Wind Dir. avg.*
- *Wind Dir. min.*
- *Wind Dir. max.*
- *Wind Speed avg.*
- *Wind Speed min.*
- *Wind Speed max.*
- *Amb. Temperature*
- *Amb. Humidity*
- *Amb. Pressure*
- *Amb. Rain Gauge*

Spectrum Parameters†

- L_{Weq}
- L_{WFmax}
- L_{WSmax}
- L_{WFmin}
- L_{WSmin}

Statistics to Calculate Percentile Levels as Spectra*

*. These parameters are available for Enhanced Logging BZ-7225 only.
†. These parameters require license for BZ-7223 and measurement of spectra.

CIC Results

- *CIC 1 Result*[*]
- *CIC 1 Dev. from Reference*[*]
- *CIC 2 Result*[*]
- *CIC 2 Dev. from Reference*[*]
- *CIC 3 Result*[†]
- *CIC 3 Dev. from Reference*[†]
- *CIC 4 Result*[†]
- *CIC 4 Dev. from Reference*[†]

In addition to the parameters saved within the data (listed above), the following can be inserted in a project annotation as a GPS Note:

- *Position* as Latitude and Longitude
- *Altitude*
- *Position error* (dependant on type of GPS unit)

B.2 Periodic Reports (Microphone Input)

B.2.1 For Enhanced Logging Software BZ-7225

Parameters measured within a Periodic Report interval:

Equivalent Continuous Sound Levels

- L_{Xeq}
- L_{Yeq}
- $L_{Ceq} - L_{Aeq}$
- $L_{Aeq,T1,mov,max}$
- $L_{Aeq,T2,mov,max}$
- $L_{Ceq,T1,mov,max}$
- $L_{Ceq,T2,mov,max}$
- $\Delta L_{eq,T,mov,max}$
- $\Delta L_{eq,T,mov,max}$

Sound Exposure Level

- L_{XE}
- L_{YE}

Peak Sound Level

- L_{Vpeak}
- T_{Vpeak}

*. These parameters are available for Logging BZ-7224 and Enhanced Logging BZ-7225 only.
†. These parameters are available for Enhanced Logging BZ-7225 only.

Maximum Time-weighted Sound Levels

- L_{XFmax}
- L_{XSmax}
- L_{XImax}
- L_{YFmax}
- L_{YSmax}
- L_{YImax}

Minimum Time-weighted Sound Levels

- L_{XFmin}
- L_{XSmin}
- L_{XImin}
- L_{YFmin}
- L_{YSmin}
- L_{YImin}

ISO/EU Occupational Health Parameters

- *E*
- *Dose*
- *ProjDose*
- *#VPeaks* (>xxx dB)
- *#VPeaks* (>137 dB)
- *#VPeaks* (>135 dB)

US Occupational Health Parameters

- L_{avRQ}
- *TWA*
- TWA_v
- *DoseRQ*
- *ProjDoseRQ*

General Parameters

- *Overload* in %
- *Start time* (common to both channels in 2-channel templates)
- *Stop Time* (common to both channels in 2-channel templates)
- *Elapsed Time* (excl. pauses; common to both channels in 2-channel templates)

Special Parameters

- L_{XIeq} (also called L_{XIm})
- L_{YIeq}
- $L_{AIeq} - L_{Aeq}$
- L_{AFTeq} (also called L_{AFTm5})
- $L_{AFTeq} - L_{Aeq}$
- *SIL* (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz)*
- *PSIL* (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz and 2000 Hz)*
- *SIL3* (average of L_{Zeq} octave band levels: 1000 Hz, 2000 Hz and 4000 Hz)*
- $L_{Weq}(f1 - f2)$ (sum of power values for L_{Weq} frequency bands from f1 Hz to f2 Hz)*

Statistics to Calculate Percentile Levels and Std.Dev.

Low-frequency Parameters (requires Low Frequency Option BZ-7234)

- L_{Geq}
- L_{G10max}
- L_{G10min}
- L_{Gpeak}
- T_{Gpeak}
- *#GPeaks (>xxx dB)*
- *#GPeaks (>137 dB)*
- *#GPeaks (>135 dB)*

Weather Data (requires connection to a weather station; common to both channels in 2-channel templates)

- *Wind Dir. avg.*
- *Wind Dir. min.*
- *Wind Dir. max.*
- *Wind Speed avg.*
- *Wind Speed min.*
- *Wind Speed max.*
- *Amb. Temperature*
- *Amb. Humidity*
- *Amb. Pressure*
- *Amb. Rain Gauge*

*. These parameters require license for BZ-7223 and measurement of spectra.

Spectrum Parameters*

- L_{Weq}
- L_{WFmax}
- L_{WSmax}
- L_{WFmin}
- L_{WSmin}

The Statistics can be logged in Periodic Reports to Calculate Percentile Levels as spectra.*

B.3 Logged Measurement (Microphone Input)

B.3.1 For Logging Software BZ-7224 and Enhanced Logging Software BZ-7225

Parameters measured within a logging interval – up to ten (or all) of the following parameters can be logged:

Equivalent Continuous Sound Levels

- L_{Xeq}
- L_{Yeq}
- $L_{Ceq} - L_{Aeq}$
- $L_{Aeq,T1,mov}$
- $L_{Aeq,T2,mov}$
- $L_{Ceq,T1,mov}$
- $L_{Ceq,T2,mov}$
- $\Delta L_{eq,T,mov}$
- $\Delta L_{eq,T,mov}$

Sound Exposure Level

- L_{XE}
- L_{YE}

Peak Sound Level:

- L_{Vpeak}

Maximum Time-weighted Sound Levels

- L_{XFmax}
- L_{XSmax}
- L_{XImax}
- L_{YFmax}
- L_{YSmax}
- L_{YImax}

Minimum Time-weighted Sound Levels

- L_{XFmin}
- L_{XSmin}
- L_{XImin}
- L_{YFmin}
- L_{YSmin}
- L_{YImin}

US Occupational Health Parameters

- L_{avRQ}

Special Parameters

- L_{XIeq} (also called L_{XIm})
- L_{YIeq}
- $L_{AIeq} - L_{Aeq}$
- L_{AFTeq} (also called L_{AFTm5})
- $L_{AFTeq} - L_{Aeq}$
- *SIL* (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz)*
- *PSIL* (average of L_{Zeq} octave band levels: 500 Hz, 1000 Hz and 2000 Hz)*
- *SIL3* (average of L_{Zeq} octave band levels: 1000 Hz, 2000 Hz and 4000 Hz)*
- $L_{Weq}(f1 - f2)$ (sum of power values for L_{Weq} frequency bands from f1 Hz to f2 Hz)*

Voltage updated at approx. 5 s intervals and logged with Logging Period intervals

- *Trig. Input Voltage* (requires Trigger Input is set to Voltage for Monitoring)

The following parameters are available per set of logged parameters

- *Overload* in %
- *Start time* (common to both channels in 2-channel templates)
- *Stop Time* (common to both channels in 2-channel templates)
- *Elapsed Time* (excl. pauses; common to both channels in 2-channel templates)

The Statistics can be logged to calculate Percentile Levels and Std.Dev. per logging interval.

Low-frequency Parameters (requires Low Frequency Option BZ-7234)

- L_{Geq}
- L_{G10max}
- L_{G10min}
- L_{Gpeak}

*. These parameters require license for BZ-7223 and measurement of spectra.

Weather Data (requires connection to a weather station; common to both channels in 2-channel templates)

- *Wind Dir. avg.*
- *Wind Dir. min.*
- *Wind Dir. max.*
- *Wind Speed avg.*
- *Wind Speed min.*
- *Wind Speed max.*
- *Amb. Temperature*
- *Amb. Humidity*
- *Amb. Pressure*
- *Amb. Rain Gauge*

Up to three (or all) of the following Spectrum parameters can be logged and displayed on the spectrum display:*

- L_{Weq}
- L_{WFmax}
- L_{WSmax}
- L_{WFmin}
- L_{WSmin}

The Statistics can be logged in Periodic Reports to Calculate Percentile Levels as spectra.*

B.4 Logged (100 ms) Measurement (Microphone Input)

B.4.1 For Logging Software BZ-7224 and Enhanced Logging Software BZ-7225

The following Broadband parameters can be logged every 100 ms

- L_{Aeq}
- L_{AF}
- L_{AS}

Note: For 2-channel templates up to four of the six parameters from the two channels can be logged (Type 2270 only).

*. These parameters require license for BZ-7223 and measurement of spectra.

B.5 Instantaneous Measured Parameters (available at any time; Microphone Input)

Instantaneous Time-weighted Sound Levels

- L_{XF}
- L_{XS}
- L_{XI}
- L_{YF}
- L_{YS}
- L_{YI}

Sound Pressure Levels (maximum time-weighted sound levels once per second)

- $L_{XF(SPL)}$
- $L_{XS(SPL)}$
- $L_{XI(SPL)}$
- $L_{YF(SPL)}$
- $L_{YS(SPL)}$
- $L_{YI(SPL)}$

Peak Sound Levels (maximum peak sound level once per second)

- $L_{Vpeak,1s}$

Low-frequency Parameters (requires Low Frequency Option BZ-7234)

- L_{G10}
- $L_{Gpeak,1s}$

Voltage updated at approx. 5 s intervals (common to both channels in 2-channel templates)

- *Trig. Input Voltage* (requires Trigger Input is set to Voltage for Monitoring)

Instantaneous Weather Data (common to both channels in 2-channel templates)

- *Wind Dir.*
- *Wind Speed*

Instantaneous GPS Data (common to both channels in 2-channel templates)

- *Latitude*
- *Longitude*

Instantaneous Measured Spectra:*

- L_{WF}
- L_{WS}

*. These parameters require license for BZ-7223 and measurement of spectra.

B.5.1 Processed Parameters for Display Only (Microphone Input)

The following general parameter is available for display for Total data: Time Remaining (for the current measurement, taking available disk space into account).

The following ISO/EU Occupational Health Parameters are calculated and displayed for Total, Periodic Reports and Logged data: $L_{ep,d}$ and $L_{ep,d,v}$

If Statistics are available, then Std.Dev. and 7 percentile levels can be calculated and displayed: LXN1 or LXUN1 to LXN7 or LXUN7.

If spectral statistics are available, then 7 percentile levels as spectra can be calculated and displayed: LWUN1 to LWUN7.

If L_{Weq} spectrum is available, then NC, NC Decisive Band, NR, NR Decisive Band, RC, RC Classification, NCB, NCB Classification can be calculated and displayed.

If L_{Weq} 1/3-octave spectrum is available, then Loudness and Loudness Level can be calculated and displayed.

For 2-channel templates:

- Single values for display:
  - Ch.1 – Ch.2 L_{Xeq}
  - Ch.2 – Ch.1 L_{Xeq}
  - Ch.1 – Ch.2 L_{Yeq}
  - Ch.2 – Ch.1 L_{Yeq}
- Spectra for display:
  - Ch.1 – Ch.2 L_{Weq}
  - Ch.2 – Ch.1 L_{Weq}

B.6 Total Measurement (Accelerometer and Direct Input)

B.6.1 For Sound Level Meter Software BZ-7222, Frequency Analysis Software BZ-7223, Logging Software BZ-7224 and Enhanced Logging Software BZ-7225

The following parameters are measured within the Elapsed Time:

Linear Averaged Levels

- *Linear*

Peak Levels

- *Peak*
- T_{Peak}

Maximum Time-weighted Levels

- *Fast max*
- *Slow max*

Minimum Time-weighted Levels

- *Fast min*
- *Slow min*

General Parameters

- *Overload in %*
- *Start time* (common to both channels in 2-channel templates)
- *Stop Time* (common to both channels in 2-channel templates)
- *Elapsed Time* (excl. pauses; common to both channels in 2-channel templates)

Special Parameters

- *Linear(f1 – f2)* (sum of power values for Linear frequency bands from f1 Hz to f2 Hz)*

Low Frequency Parameters (requires low frequency option BZ-7234 and accelerometer input)

- *aW*
- aW_{Crest}
- *MTVV*
- KBF_{max}
- KBF_{Tm}
- $Peak_{W}$

Spectrum Parametersa

- *Linear* (or aW; requires low frequency option BZ-7234 and accelerometer input)
- *Fast max*
- *Slow max*
- *Fast min*
- *Slow min*

In addition to the parameters saved within the data (listed above), the following can be inserted in a project annotation as a GPS Note (common to both channels in 2-channel templates):

- *Position as Latitude and Longitude*
- *Altitude*
- *Position error (dependant on type of GPS unit)*

*. These parameters require a license for BZ-7223 and spectra measurement.

B.6.2 Periodic Reports (Accelerometer or Direct input)

For Enhanced Logging Software BZ-7225

Parameters measured within a Periodic Report interval:

Linear Averaged Levels

- *Linear*

Peak Levels

- *Peak*
- T_{Peak}

Maximum Time-weighted Levels

- *Fast max*
- *Slow max*

Minimum Time-weighted Levels

- *Fast min*
- *Slow min*

General Parameters

- *Overload in %*
- *Start time* (common to both channels in 2-channel templates)
- *Stop Time* (common to both channels in 2-channel templates)
- *Elapsed Time* (excl. pauses; common to both channels in 2-channel templates)

Special Parameters

- *Linear(f1 – f2)* (sum of power values for Linear frequency bands from f1 Hz to f2 Hz)*

Low Frequency Parameters (requires low frequency option BZ-7234 and accelerometer input)

- *aW*
- aW_{Crest}
- *MTVV*
- KBF_{max}
- KBF_{Tm}
- $Peak_W$

Spectrum Parameters*

- *Linear* (or aW; requires low frequency option BZ-7234 and accelerometer input)
- *Fast max*
- *Slow max*
- *Fast min*
- *Slow min*

*. These parameters require a license for BZ-7223 and spectra measurement.

B.6.3 Logged Measurement (Accelerometer or Direct input)

For Logging Software BZ-7224 and Enhanced Logging Software BZ-7225

Parameters measured within a logging interval - up to five (or all) of the following parameters can be logged:

Linear Averaged Levels

- *Linear*

Peak Levels

- *Peak*

Maximum Time-weighted Levels

- *Fast max*
- *Slow max*

Minimum Time-weighted Levels

- *Fast min*
- *Slow min*

General Parameters

- *Overload in %*
- *Start time* (common to both channels in 2-channel templates)
- *Stop Time* (common to both channels in 2-channel templates)
- *Elapsed Time* (excl. pauses; common to both channels in 2-channel templates)

Special Parameters

- *Linear(f1 – f2)* (sum of power values for Linear frequency bands from f1 Hz to f2 Hz)*

Low Frequency Parameters (requires low frequency option BZ-7234 and accelerometer input)

- *aW*
- aW_{Crest}
- *MTVV*
- KBF_{max}
- KBF_{Tm}
- $Peak_W$

Spectrum Parameters*

- *Linear* (or aW; requires low frequency option BZ-7234 and accelerometer input)
- *Fast max*
- *Slow max*
- *Fast min*
- *Slow min*

*. These parameters require a license for BZ-7223 and spectra measurement.

B.6.4 Logged (100 ms) Measurement (Accelerometer or Direct input)

For Logging Software BZ-7224 and Enhanced Logging SoftwareBZ-7225

The following Broadband parameters can be logged every 100 ms

- *Linear*
- *Fast Inst*
- *Slow Inst*

Note: For 2-channel templates, up to four of the six parameters from the two channels can be logged (Type 2270 only)

B.6.5 Instantaneous Measured Parameters (Available at Any Time; Accelerometer or Direct input)

Instantaneous Time-weighted Levels

- *Fast Inst*
- *Slow Inst*

Low Frequency Parameters (requires Low Frequency Option BZ-7234 and accelerometer input)

- $a_{W,1s}$
- *KBF*

Voltage updated at approx. 5 s intervals (common to both channels in 2-channel templates)

- *Trig. Input Voltage* (requires Trigger Input is set to Voltage for Monitoring)

Instantaneous GPS Data (common to both channels in 2-Ch. templates)

- *Latitude*
- *Longitude*

Instantaneous Measured Spectra*

- *Fast Inst*
- *Slow Inst*

*. These parameters require a license for BZ-7223 and spectra measurement.

Processed Parameters for Display Only (Accelerometer or Direct input)

The following general parameter is available for display for Total data:

- *Time Remaining* (for the current measurement, taking available disk space into account)

For 2-channel templates:

- Single values for display:
  - Ch.1 – Ch.2 Linear
  - Ch.2 – Ch.1 Linear
- Spectra for display:
  - Ch.1 – Ch.2 Linear
  - Ch.2 – Ch.1 Linear

B.6.6 Relationship Between Setup and Measurement Parameters

The measurement parameters are measured in accordance with the setup parameters. The following tables describe the relationship between the setup and measurement parameters:

Table B.1 *General parameters*

Parameter	LXeq	LXE	LXIeq	LAFTeq	LVpeak	TVpeak	LXYmax	LXYmin
Sound Field Correction	●	●	●	●	●	●	●	●
Windscreen Correction	●	●	●	●	●	●	●	●
Low Frequency	●	●	●	●	●	●	●	●
Broadband (excl. Peak)	●	●	●	A			●	●
Broadband Peak					●	●		

Table B.2 *Noise indicators and statistics*

Parameter	L_{day}	$L_{evening}$	L_{night}	L_{den}	L_{dn}	LXYN
Sound Field Correction	●	●	●	●	●	●
Windscreen Correction	●	●	●	●	●	●
Low Frequency	●	●	●	●	●	●
Broadband (excl. Peak)	A	A	A	A	A	●
Broadband Statistics based on						●
Percentile N%						●
Day Start	●		●	●		
Evening Start	●	●		●		
Night Start		●	●	●		
Evening Penalty				●		
Night Penalty				●		

Table B.3 *Occupational health parameters*

Parameter	$L_{ep,d}$	$L_{ep,d,v}$	E	Dose	ProjDose	#VPeaks (>NNNdB)	LavRQ	TWA	TWA_v	Dose-RQ	Proj-DoseRQ
Sound Field Correction	●	●	●	●	●	●	●	●	●	●	●
Wind-screen Correction	●	●	●	●	●	●	●	●	●	●	●
Low Frequency	●	●	●	●	●	●	●	●	●	●	●
Broadband (excl. Peak)	A	A	A	A	A		A	A	A	A	A
Broadband Peak						●					
Exposure Time	●	●									
Reference Time		●							●		
Threshold Level				●	●			●	●	●	●
Criterion Level				●	●					●	●
Peaks-Over Level						●					
Exchange Rate for Lav							●	5	5	●	●
Time Weighting for Lav							●	S	S	●	●

B.7 Reverberation Time Measurement

B.7.1 For Reverberation Time Software BZ-7227

The following parameters are measured or calculated at each position:

Decays

- *Reverberation Decays (for each frequency band from Bottom Frequency to Top Frequency) based on sampling L_{Zeq} spectra at 5 ms intervals*

Spectra

- *T30 Spectrum*
- *T20 Spectrum*
- *EDT Spectrum*

Single Number Values

- T30 (*Wide Band RT Bottom – Wide Band RT Top*)
- T20 (*Wide Band RT Bottom – Wide Band RT Top*)
- EDT (*Wide Band RT Bottom – Wide Band RT Top*)

The following parameters are calculated for the room as an average of all positions:

Decays

- *Ensemble Averaged Reverberation Decays (for each frequency band from Bottom Frequency to Top Frequency)*

Spectra

- *T30 Spectrum*
- *T20 Spectrum*
- *EDT Spectrum*

Single Number Values

- T30 (*Wide Band RT Bottom – Wide Band RT Top*)
- T20 (*Wide Band RT Bottom – Wide Band RT Top*)
- EDT (*Wide Band RT Bottom – Wide Band RT Top*)

Quality indicators are given for each frequency band, in each reverberation time spectrum, and for each reverberation time spectrum.

Instantaneous Measured Parameters (available at any time)

Instantaneous Time-weighted Sound Levels:

- L_{AF}
- L_{CF}

Instantaneous Measured Spectra:

- L_{ZF}

Appendix C

Analyzer Parameters

This appendix describes the parameters that are common to all users of the analyzer.

C.1 Current Transducer

Table C.1 *Current Transducer parameters*

Parameter	Values	Comment
Transducer (that is, connected to *Top Socket*) (Ch. 1 for Type 2270)	*Name and serial number of transducer*	This parameter selects which transducer is connected to the Top Socket (displayed in *Setup* > *Input* (Type 2250) or *Setup* > *Input* under *Ch.1* (Type 2270) and at the top of **Transducers Database**)
Transducer (that is, connected to Top Socket or Ch. 2 for Type 2270)	*Name and serial number of transducer*	Type 2270 only. This parameter selects which transducer is connected to the Top Socket or *Ch. 2* (displayed in *Setup* > *Input* under *Ch.2* and at the top of **Transducers Database**)
Transducer (that is, connected to the Rear Socket/Ch. 1 of Type 2270)	*Name and serial number of transducer*	Type 2270 only. This parameter selects which transducer is connected to the *Ch. 1* Rear Socket (displayed in *Setup* > *Input* under *Ch.1* and at the top of **Transducers Database**)

Table C.1 *(Cont.) Current Transducer parameters*

Parameter	Values	Comment
Transducer (that is connected to Rear Socket or Ch. 2 of Type 2270)	*Name and serial number of transducer*	This parameter selects which transducer is used in the Rear Socket (displayed in *Setup* > *Input* (Type 2250) or *Setup* > *Input* under *Ch.2* (Type 2270) and at the top of **Transducers Database**)
Input (no text is displayed)	*Top Socket* *Rear Socket*	Determines whether the input is taken from the *Top Socket*, or the *Rear Socket* ('Input' on connector panel). Connect your transducer to this socket. This parameter is displayed in *Setup* > *Input* > and on the second line of the **Transducers Database**

C.2 Transducer Database

The Transducer Database consists of a Transducer Setup and a Calibration History – one set per transducer.

C.2.1 Transducer Setup

Table C.2 *Transducer Setup parameters (for Microphone, Accelerometer or Direct, unless stated otherwise)*

Parameter	Values	Comment
Serial No.	*Text string*	Insert unique ID for transducer
Name	*Text string*	Insert name of transducer to display together with serial number
Description	*Text string*	Insert description of transducer
Preamplifier ID No.	*Text string*	Document the preamplifier here

Table C.2 *(Cont.) Transducer Setup parameters (for Microphone, Accelerometer or Direct, unless stated otherwise)*

Parameter	Values	Comment
Microphone Type	*4189* *4190* *4191* *4950* *4955-A* *4193* *4193, UC-0211* *4964* *4964, UC-0211* *4952 0°* *4952 90°* *4184-A 0°* *4184-A 90°* *EH-2152 0°* *EH-2152 90°* *Unknown*	Microphone only: If the microphone is a known type, then the rest of the parameters of the transducer are set automatically. *Sound Field Correction* and *Windscreen Correction* are possible for known microphone types only. **Note:** Microphone Types 4952 and 4184-A can be used with 0° reference direction or 90° reference direction. For unknown microphone types, set the rest of the parameters – no corrections can be made for unknown types **Note:** If you are unsure which microphone to use, please refer to Table C.5, which gives an overview of the microphones, where they can be used and their specifications
Accelerometer Type	*4397-A* *4513* *4513-001* *4513-002* *4514* *4514-001* *4514-002* *4533-B* *4533-B-001* *4533-B-002* *4534-B* *4534-B-001* *4534-B-002* *6233-C-10* *8324* *8341* *8343* *8347-C, 2647-D* *Unknown*	Accelerometer only: If accelerometer is a known type, then the rest of the parameters of the transducer are set automatically. For unknown accelerometer types, set the rest of the parameters.
Nominal Sensitivity	Double	Set automatically for known type. Otherwise set the nominal sensitivity in mV/Pa for microphones; in mV/(m/s^2) for accelerometers; and in V/V for Direct input
Polarization Voltage	*Yes* *No*	Microphone only: Set to *No* if microphone is prepolarized, otherwise set to *Yes* for polarization voltage of 200 V (*Top Socket* only). Set automatically for known *Microphone Type*

Table C.2 *(Cont.) Transducer Setup parameters (for Microphone, Accelerometer or Direct, unless stated otherwise)*

Parameter	Values	Comment
Free-field Type	*Yes* *No*	Microphone only: Set to *Yes* for Free-field types, otherwise set to *No*. Set automatically for known *Microphone* type
Capacitance	Double	Microphone only: Insert capacitance of microphone in pF. Set automatically for known *Microphone* type
CCLD	*Yes* *No*	Set to *Yes* for CCLD (Constant Current Line Drive) transducers, otherwise set to *No*. Set automatically for known *Microphone* or *Accelerometer* Type. **Note:** Set *Input* to *Rear Socket*. The CCLD input at the Rear socket will automatically be enabled when selecting a transducer requiring CCLD input
Calibration Check	*CIC* *Actuator*	Microphone only: For microphone Type 4184-A you can select to check the calibration of the system using CIC or Actuator – for all other microphone types the setting is preset to CIC.
Weight	*Double*	Accelerometer only: Insert weight of the accelerometer in g. Set automatically for known Accelerometer type

C.2.2 Calibration History

Table C.3 *Calibration History parameters*

Parameter	Values	Comment
1. Calibration date & Time	*YYYY-MM-DD hh:mm:ss*	Initial
1. *Sensitivity*	Double	Initial mV/Pa
1. *Preamplifier ID No.*	Text string	Initial
1. *User*	Text string	Initial
1. *Input*	*Top Socket*, *Rear Socket*	Initial
1. *Calibration Type*	External,Internal	Initial
1. *Calibrator Serial No.*	Text string	Initial
1. *Comment*	Text string	Initial

Table C.3 *(Cont.) Calibration History parameters*

Parameter	Values	Comment
1. Analyzer Serial No.	Text string	Initial
2. Calibration date & Time	*YYYY-MM-DD hh:mm:ss*	
2. *Sensitivity*	Double	
2. *Preamplifier ID No.*	Text string	
2. *User*	Text string	
2. *Input*	*Top Socket*, *Rear Socket*	
2. *Calibration Type*	External,Internal	
2. *Calibrator Serial No.*	Text string	
2. *Comment*	Text string	
2. Analyzer Serial No.	Text string	
:	:	:
N. Calibration date & Time	*YYYY-MM-DD hh:mm:ss*	Current
N. *Sensitivity*	Double	Current
N. *Preamplifier ID No.*	Text string	Current
N. *User*	Text string	Current
N. *Input*	*Top Socket*, *Rear Socket*	Current
N. *Calibration Type*	External,Internal	Current
N. *Calibrator Serial No.*	Text string	Current
N. *Comment*	Text string	Current
N. Analyzer Serial No.	Text string	Current

C.3 Calibration Setup

Table C.4 *Calibration Setup parameters*

Parameter	Values	Comment
(Sound Level) *Calibrator*	*4231* *Custom*	Select which calibrator to use
Calibration Level (for Custom Sound Level Calibrator)	*0.00* to *200.00 dB* re 20 µPa	Set calibration level for custom calibrator
Serial No. for 4231	*Text string*	Serial number will be documented in calibration history

Table C.4 *(Cont.) Calibration Setup parameters*

Parameter	Values	Comment
Serial No. for Custom Sound Level Calibrator	*Text string*	Serial number will be documented in calibration history
(Acceleration) *Calibrator*	*4294* *4924--002* *Custom*	Select which calibrator to use
Calibration Level (for custom Acceleration Calibrator)	*0* to *1000 m/s^2*	Set calibration level for custom calibrator. **Note**: When displaying acceleration levels as dB the reference will be 1 µm/s2
Serial No. for 4294	*Text string*	Serial number will be documented in calibration history
Serial No. for Custom Acceleration Calibrator	*Text string*	Serial number will be documented in calibration history
Calibration Level (for Direct Input)	*0* to *1000 V*	Set calibration level for Direct Input **Note**: When displaying voltage levels as dB the reference will be 1 µV
Serial No. for Direct Input Calibrator	*Text string*	Serial number will be documented in calibration history

C.4 Type 2250/2270 Microphones

Table C.5 *Overview of Type 2250/2270 Microphones*

Micro-phone	Application	Optimised For	Dynamic Range*	Free-field ±1 dB Frequency Range	Free-field ±2 dB Frequency Range
4184-A	Weatherproof 200 V	Free Field 0° or 90° Diffuse Field	28.8 – 150 dB(A)	3.6 Hz – 15.0 kHz† 6.6 Hz – 15.0 kHz	2.5 Hz – 16.5 kHz† 5.6 Hz – 16.5 kHz
4189	Standard Prepolarized	Free Field Diffuse Field	16.6 – 140 dB(A)	6.8 Hz – 22.4 kHz† 7.8 Hz – 22.4 kHz	4.2 Hz – 22.4 kHz† 6.3 Hz – 22.4 kHz
4190	Standard 200 V	Free Field Diffuse Field	16.5 – 140 dB(A)	4.0 Hz – 22.4 kHz† 6.7 Hz – 22.4 kHz	2.6 Hz – 22.4 kHz† 5.7 Hz – 22.4 kHz
4191	High Levels 200 V	Free Field Diffuse Field	25.6 – 152 dB(A)	3.6 Hz – 22.4 kHz† 6.6 Hz – 22.4 kHz	2.5 Hz – 22.4 kHz† 5.6 Hz – 22.4 kHz
4193	Low Frequencies	Low Frequencies	23.2 – 152 dB(A) 38.4 – 152 dB(Z)†	0.56 Hz – 22.4 kHz† 6.3 Hz – 22.4 kHz	0.45 Hz – 22.4 kHz† 5.5 Hz – 22.4 kHz

Table C.5 *(Cont.) Overview of Type 2250/2270 Microphones*

Micro-phone	Application	Optimised For	Dynamic Range*	Free-field ±1 dB Frequency Range	Free-field ±2 dB Frequency Range
4193 + UC-0211	Low Frequencies 200 V	Low Frequencies Free Field Diffuse Field	37.8 – 142 dB(A) 39.1 – 142 dB(Z)‡	0.38 Hz – 22.4 kHz‡	0.28 Hz – 22.4 kHz‡
4950	Standard Prepolarized	Free Field Diffuse Field	16.4 –140 dB(A)	4.3 Hz – 19.0 kHz† 6.3 Hz – 19.0 kHz	3.2 Hz – 20.0 kHz† 5.6 Hz – 20.0 kHz
4952	Outdoor Prepolarized	Free Field 0° or 90° Diffuse Field	20.0 – 141 dB(A)	4.3 Hz – 14.0 kHz† 6.3 Hz – 14.0 kHz	3.2 Hz – 14.5 kHz† 5.6 Hz – 14.5 kHz
4952 + EH-2152	Outdoor Prepolarized	Free Field 0° or 90° Diffuse Field	20.0 – 141 dB(A)	4.3 Hz – 14.0 kHz† 6.3 Hz – 14.0 kHz	3.2 Hz – 14.5 kHz† 5.6 Hz – 14.5 kHz
4955-A	Low Noise 200 V	Free Field Diffuse Field	4.2 – 95 dB(A)	9.2 Hz – 19.0 kHz† 9.2 Hz – 19.0 kHz	6.0 Hz – 20.0 kHz† 7.0 Hz – 20.0 kHz
4964	Low Frequencies Prepolarized	Low Frequency Free Field Diffuse Field	16.6 – 140 dB(A) 27.3 – 140 db(Z)†	0.6 Hz – 22.4 kHz† 6.0 Hz – 22.4 kHz	0.47 Hz – 22.4 kHz† 5.3 Hz – 22.4 kHz
4964 + UC-0211	Low Frequencies Prepolarized	Low Frequency Free Field Diffuse Field	30.0 – 130 dB(A) 34.7 – 130 db(Z)‡	0.35 Hz – 22.4 kHz‡	0.28 Hz – 22.4 kHz‡

*. From the typical total inherent noise level for the microphone and Type 2250/2270, to the overload limit for a sinusoidal signal at 1 kHz.
†. Type 2250/2270 *Low Frequency* set to *Extended.*
‡. Type 2250/2270 *Low Frequency* set to *Very Low.*

Detailed specifications for the analyzer together with the different microphones are available. Please contact your local Brüel & Kjær representative if you need more information.

The analyzer has correction filters to optimise the frequency response of each microphone. The relevant filter is automatically applied when you select the microphone for input, be it via the top socket, or the rear input socket.

Note for Microphone Type 4193 and Type 4964

Microphone Type 4193 is delivered with the Adaptor UC-0211; for Microphone Type 4964 it is ordered separately.

Adaptor UC-0211 is only used when measurements are made on signals that contain components at frequencies below 1 Hz that should be included in the measurement. This is only for the *Low Frequency* parameter set to *Very Low.*

It is not recommended to use the adaptor for other signals or settings because it reduces the dynamic range significantly.

Appendix D

Preferences

This appendix describes the unique set of parameters that can be set for each user on the analyzer.

D.1 Display Settings

For each colour scheme select the optimum choice of brightness for the traffic light and whether the backlight for the pushbuttons should be on or off. In addition, you can also change the number of decimal places on your dB results readout

Table D.1 *Display settings*

Parameter	Values	Comment
Colour Scheme	*Arcade* *Alhambra* *Indoor* *Outdoor* *Night*	Select between five colour schemes, one optimised for outdoor use in bright conditions and one optimised for very dark conditions
Traffic Light Brightness	*Off* *Low* *Normal* *High*	
Key Backlight	*Off* *On*	
Backlight Brightness	*Minimum* *Level 2* *Level 3* *Level 4* *Level 5* *Maximum*	Select backlight brightness using the backlight icon at the bottom of the screen. *Maximum* level uses the most power

Table D.1 *(Cont.) Display settings*

Parameter	Values	Comment
Resolution of Readings	*Normal* *Extended*	*dB*: Number of decimal places for values displayed: *Normal, 1*; *Extended, 2* *Engineering*: Number of digits for values displayed: *Normal, 3*; *Extended, 4* **Note:** This setting is for display only and has no effect on the measurement precision or resolution

D.2 Power Settings

Table D.2 *Power settings*

Parameter	Values	Comment
Backlight Dim	*After 30 sec.* *After 1 min.* *After 2 min.* *After 5 min.* *After 10 min* *Never*	Select optimum value for full backlight on (brightness determined by *Backlight Brightness*) before the backlight is dimmed (if analyzer is left untouched)
Turn off Backlight	*After 1 min.* *After 2 min.* *After 5 min.* *After 10 min.* *After 30 min.* *Never*	Hardware versions 1 – 3 only: Select optimum value for how long the backlight is dimmed before it is switched off
Standby	*After 1 min.* *After 2 min.* *After 5 min.* *After 10 min.* *After 30 min.* *Never*	Select optimum value for ‘on’ period before the analyzer is set automatically to standby
Ext. Power	*Charge battery only* *Switch on and charge*	Hardware version 4 only: The *Ext. Power* setting determines whether the analyzer automatically switches on and charges when applied to external power or the analyzer just charges the battery. Hardware versions 1 – 3: This functionality is determined by a small, manual switch at the back of the analyzer. Remove the internal battery pack to access the switch

Note: If the analyzer is externally powered, then the settings will be ignored.

D.3 Regional Settings

Table D.3 *Regional settings*

Parameter	Values	Comment
Decimal Point	. ,	Select your preferred decimal point
Date separator	– / .	Select your preferred date separator
Date Format	*yyyy-MM-dd HH:mm:ss* *dd-MM-yyyy HH:mm:ss* *MM-dd-yyyy HH:mm:ss* *yy-MM-dd hh:mm:ss XX* *dd-MM-yy hh:mm:ss XX* *MM-dd-yy hh:mm:ss XX*	Select your preferred date format: *HH* = 24 hour, *hh* = 12 hour, *XX* = AM or PM
Time Zone	*GMT–12* *GMT* *GMT+13*	Select the time zone of your region
Language	*English, ...*	A number of different languages are available for the analyzer. Hardware versions 1 – 3: Select your preferred language – if it is not on the list, then it might be available for installation using BZ-5503 Hardware version 4: All languages are installed
Keyboard	*United Kingdom, ...*	33 different keyboards. Select your preferred keyboard
Wind Speed Unit	*SI or US/UK*	Select *SI* for m/s or *US/UK* for mph
Temperature Unit	*SI or US/UK*	Select *SI* for °C or *US/UK* for °F
Dimension Unit	*SI or US/UK*	Select *SI* for m or *US/UK* for ft
Vibration Unit	*SI or US/UK*	Select *SI* for m/s^2 or *US/UK* for g

D.4 Storage Settings

Table D.4 *Storage Settings*

Parameter	Values	Comment
Auto-naming of Projects	*Yes* *No*	Select *Yes* for automatically naming projects from the start date of the project as Year, Month, Date in the format YYMMDD, (for example, 051112 as 2005, November 12th) Select *No* for using the name defined in the *Project Name Prefix* parameter
Project Name Prefix	*Text string*	Prefix for automatically generated project name. Maximum 8 characters

D.5 Headphone Settings

Table D.5 *Headphone Settings*

Parameter	Values	Comment
Listen to signal	*No* *Input X-weighted* *Input C-weighted* *Input Z-weighted*	In addition to the commentary annotations, you can listen to the input signal for monitoring purposes. Select one of the A-weighted, B-weighted, C-weighted or Z-weighted signals. **Note 1:** The frequency weighting of the signal you listen to can be selected independently of the frequency weighting of the measurement, the signal at the output socket and the signal used for signal recording **Note 2:** *X* = frequency weighting A or B. 'A' requires that the *Broadband (excl. Peak)* parameter is set to *AC or AZ.* 'B' requires that the *Broadband (excl. Peak)* parameter is set to *BC or BZ*

Table D.5 *(Cont.) Headphone Settings*

Parameter	Values	Comment
Automatic Gain Control	*On* *Off*	To ease identification of sound sources, the gain can be automatically adjusted to keep the average level within a 40 dB range. When playing back the recorded signal, you will then hear clearly the whole signal content, whether the level has been 20 dB or 140 dB. Set *Automatic Gain Control* to *On* to convert the signal at the headphone output. Set *Automatic Gain Control* to *Off* for listening to the signal with a fixed gain
Gain for Meas.Signal	*– 80.0 dB* to *60.0 dB* for *Automatic Gain Control* set to *Off* *– 60.0 dB to* 0.0 dB for *Automatic Gain Control* set to *On*	Key in a gain value (0.1 dB resolution) for the measurement input signal. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/decrement the value in steps of 1 dB. **Note:** 0 dB means 1 V output for 1 V input (*Automatic Gain Control* set to *Off*)
Gain for Annotations	*– 60 dB* to *60.0 dB*	Key in a gain value (1.5 dB resolution) for the commentary annotations. Use '@' to assign the new value for immediate response at the output – or use the up/down navigation keys to increment/decrement the value in steps of 1.5 dB. **Note:** Maximum gain is limited to 0 dB for 16-bit wav-files

D.6 Users

Table D.6 *Users*

Parameter	Values	Comment
Multi User	*Enabled*	Set to *Enabled* to enable the Multi-user facility
	Disabled	Set to *Disabled* if you are the only user

D.7 Printer Settings

Table D.7 *Printer settings*

Parameter	Values	Comment
Printer Used	*None*	Select *None* if you do not have a printer connected to the analyzer.
	MPS	Select *MPS* for a Mobile Pro Spectrum thermal printer from AM-TECH.
	PCL	Select *PCL* for a printer accepting PCL printer language.
	PCL Inkjet	Select *PCL Inkjet* for an inkjet printer accepting PCL language.
	PCL Laser	Select *PCL Laser* for a laser printer accepting PCL language.
	Seiko DPU	Select *Seiko DPU* for the DPU-S245 or DPU-S445 thermal printer model from Seiko Instruments. See Chapter 8 for more details
Top Margin	*0.0* to *20.0 cm*	Use *Top Margin* to position the print on the paper
Left Margin	*0.0* to *20.0 cm*	Use *Left Margin* to position the print on the paper
Width	*1.0* to *15.0 cm*	Use *Width* to set the size of the print
Height	*1.4* to *20.0 cm*	Use *Height* to set the size of the print

D.8 Modem/DynDNS Settings

Table D.8 *Modem/DynDNS settings*

Parameter	Values	Comment
Modem	*Disabled* *GPRS/EDGE/HSPA Dialup*	Set to *Disabled* if you do not have a modem connected; if you have connected a modem, but only want to use the SMS facility of the modem; or, when you physically connect or disconnect the modem. Set to *GPRS*/EDGE/HSPA *Dialup* if you have a *GPRS*/EDGE/HSPA modem connected and you want the analyzer to be connected to the Internet. See Chapter 7 and Chapter 8 for more details
Dialup Networking		
APN (Access Point Name)	*Character string*	*Access Point Name* is an identifier required by the network operator. Examples are 'Internet', 'public' and 'www.vodaphone.de'. Please consult your network operator
User Name	*Character string*	Set *User Name* as required by your network operator. Typically this can be left empty
Password	*Character string*	Set *Password* as required by your network operator. Typically this can be left empty
Domain	*Character string*	Set *Domain* as required by your network operator. Typically this can be left empty
DynDNS		
Active	*No* *Yes*	Set to *Yes* to make the update of the IP address at DynDNS.com active. Set to *No* if you do not use this service
Hostname	*Character string*	Set the *Hostname* defined in your account at DynDNS.com
User Name	*Character string*	Set the *User Name* for your account at DynDNS.com
Password	*Character string*	Set the *Password* for your account at DynDNS.com. The password will be displayed until you press **Enter**, then it will be replaced by '***'

D.9 Network Settings

Table D.9 *Network settings*

Parameter	Values	Comment
Location	*Up to 20 characters*	Use *Location* to specify a text identifying the analyzer or location of the analyzer. The *Location* will be displayed on the PC together with the serial number of the analyzer when browsing for analyzers in BZ-5503, and when connected using the online display
Network Connection	*None* *CF Socket* *LAN Socket*	Set to *None* if no Ethernet CF Card is present in CF Socket (Type 2250 only) Set to *CF* Socket if Ethernet CF Card is present in CF Socket Set to *LAN* Socket if you want to use the built-in LAN Socket (Type 2270 only)
Set IP Address	*Automatically* *Manually*	Set to *Automatically* to obtain an IP address from a DHCP server. If no server is available, then a Link-local address will be set Set to *Manually* to set the *IP address*, *Subnet Mask*, *Default Gateway*, *Preferred DNS* and *Alternate DNS* manually
IP Address	*xxx.xxx.xxx.xxx*	The IP address of the analyzer Selectable if *Set IP Address* = *Manually*
Subnet Mask	*xxx.xxx.xxx.xxx*	The *Subnet Mask* combined with the IP address identifies the network segment the analyzer is on Selectable if *Set IP Address* = *Manually*
Default Gateway	*xxx.xxx.xxx.xxx*	Address to a gateway for routing to another network Selectable if *Set IP Address* = *Manually*
Preferred DNS	*xxx.xxx.xxx.xxx*	The IP address of the primary DNS server
Alternate DNS	*xxx.xxx.xxx.xxx*	The IP address of the secondary DNS server

Table D.9 *(Cont.) Network settings*

Parameter	Values	Comment
Name	*Up to 32 characters*	Name (SSID) of network you want to connect to. Update the name either by entering a name directly, or by tapping on the *Available Networks* and selecting a name from the list
Security	*Open* *Shared* *WPA PSK* *WPA2 PSK*	Select security as required by the network *Open* and *Shared* are for WEP (Wired Equivalent Privacy) Infrastructure mode *WPA PSK* is for WPA (Wi-Fi Protected Access) with Pre-shared Key (also called Personal mode) *WPA2 PSK* – WPA2 is an enhanced version of WPA
Encryption	*None* *WEP Enabled* *AES Enabled* *TKIP Enabled*	Select *Encryption* as required by the network *None* is for Open security *WEP Enabled* is for Open and Shared security *AES Enabled* and *TKIP Enabled* are for WPA PSK and WPA2 PSK
Encryption Key	*Up to 32 characters*	Insert the encryption key required by the network. The key will be displayed until you press **Enter**, then it will be replaced by '***'

D.10 Notification Settings

Table D.10 *Notification settings*

Parameter	Values	Comment
Notification	*Disabled* *E-mail* *SMS*	Set to *Disabled* to disable notifications. Set to *E-mail* to send notifications as e-mail when an alarm occurs. Set to *SMS* to send notifications as SMS when an alarm occurs. See section 8.4 for the list of alarm types
Daily Status	*Enable* *Disable*	Set to *Enable* to send a notification once per day
Send at	*00:00:00* to *23:59:59*	Determines the time of day to send the daily status notification
Alarm Settings		
Internal Battery	*High* *Low* *Critical*	A notification is sent, if internal battery enters the set state
Trigger Input Voltage	*–20.0 V* to *+20.0 V*	A notification is sent, if voltage level at trigger input drops to or below this setting. **Note:** This alarm requires *Setup* > *Input* > *Trigger Input* is set to *Voltage for Monitoring*
Disk Space	*0%* to *100%*	A notification is sent, if free disk space drops to or below this setting
Level Trigger Events	*Disabled* *Enabled*	A notification is sent, if *Level Trigger* (specified in *Setup* > *Level Trigger* in Logging Software or in *Setup* > *Triggers* in Enhanced Logging Software) is exceeded
Report Level Notifications	*Disable* *Enable*	Set to *Enable* to send a notification when the measured L_{Aeq} for the latest Report Period exceeds *Report Threshold Level* (the functionality is only available when running the Enhanced Logging template)
Report Threshold Level	*–100.0 dB* to *200.0 dB*	A notification is sent when the measured L_{Aeq} (for Microphone input) or Linear (for Acceleration and Direct input) for the latest Report Period exceeds the set *Report Threshold Level*. **Note 1:** If you specify a very low *Report Threshold Level* you will receive a notification at the end of each Report Period **Note 2:** For 2-channel Enhanced Logging, the Report Threshold Level is for Ch.1

Table D.10 *(Cont.) Notification settings*

Parameter	Values	Comment
Report Threshold Level 2	*–100.0 dB* to *200.0 dB*	A notification is sent when the measured Ch.2 L_{Aeq} (for Microphone input) or Linear (for Acceleration and Direct input) for the latest Report Period exceeds the set *Report Threshold Level 2*. Only used in 2-ch Enhanced Logging.
E-mail		
To	*Character string*	The e-mail address of the recipient of the e-mail. Example: recipient@gmail.com
SMTP	*Character string*	Name of SMTP (Simple Mail Transfer Protocol) Server.* Examples: gmail: smtp.gmail.com hotmail: smtp.live.com
SMTP Port	*0* to *65535*	Port used by SMTP Server.[a] Typically this is *25*, but for Gmail/Google Mail and Microsoft® Hotmail® it is *587*
SSL/TLS	*No* *Yes*	Secure Socket Layer/Transport Layer Security. Set to *Yes* if required by e-mail provider[a], otherwise *No*. SSL/TLS is required by Gmail and Hotmail
Account	*Character string*	The account is typically the e-mail address of the e-mail used for sending the e-mail.[a] Examples: myaddress@gmail.com myaddress@hotmail.com
User Name	*Character string*	The User Name is typically the e-mail address of the e-mail used for sending the e-mail.[a] Examples: myaddress@gmail.com myaddress@hotmail.com If the e-mail account is part of a domain, then it might be necessary to specify the domain as part of the user name Example: Domain\UserName
Password	*Character string*	Insert the password required for the account.[a] The password will be displayed until you press **Enter**, then it will be replaced by '***'
SMS		
Active	*No* *Yes*	Set to *Yes* to activate the first phone number, otherwise set to *No*
Name	*Character string*	Name identifying first phone number
Phone Number	*Number*	The number of the first SMS recipient

Table D.10 *(Cont.) Notification settings*

Parameter	Values	Comment
Active	*No* *Yes*	Set to *Yes* to activate the second phone number, otherwise set to *No*
Name	*Character string*	Name identifying second phone number
Phone Number	*Number*	The number of the second SMS recipient

*. Please consult your e-mail provider

D.11 Remote Access Settings

Table D.11 *Remote Access settings*

Parameter	Values	Comment
Web Server	*Disabled* *Enabled*	Set *Web Server* to *Enabled* to enable display and control of the analyzer on a web page – see section 7.4. Set to *Disabled* to disable the web server functionality
BZ-5503 Login Required	*Yes* *No*	Set to *Yes* to require user name and password for access to the instrument from BZ-5503 MPS or from the 2250/2270 SDK. Set to *No* for free access to the instrument. **Note:** If set to *Yes*, then you require BZ-5503 version 4.1 or higher to access the instrument
User Name	*Character string*	Define the *User Name* required for full access to the web page, that is, view and control of the analyzer, and for access from BZ-5503 MPS and 2250/2270 SDK. Default: *admin*
Password	*Character string*	Define the password required for full access to the web page, and for access from BZ-5503 MPS and 2250/2270 SDK. The password will be displayed until you press **Enter**, then it will be replaced by '***'. Default: *admin*
Guest Login Required	*Yes* *No*	Set to *Yes* to require user name and password for login to the guest web page. Set to *No* for free access to the guest web page.
Guest User Name	*Character string*	Define the *User Name* required for limited access to the web page, that is view of the analyzer only Default: *guest*
Guest Password	*Character string*	Define the password required for limited access to the web page. The password will be displayed until you press **Enter**, then it will be replaced by '***' Default: *guest*

Note: The remote access parameters are common to all users of the analyzer.

D.12 Image Settings (Type 2270 only)

Table D.12 *Image settings (Type 2270 only)*

Parameter	Values	Comment
Image Control	*View Finder* *Manual Event*	Set to *View Finder* to use the Viewfinder together with the **Manual Event** key to capture an image. The image can then be saved or rejected after capture Set to *Manual Event* to capture and save the image each time you press the **Manual Event** key

D.13 NMT Server Settings (Hardware Version 4 only)

For setup of NMT Server communication used by Noise Monitoring Software BZ-7232, see User Manual for Noise Monitoring Terminal Types 3639-A, B and C, BE 1818.

Appendix E

Glossary

A-weighting filter: Frequency weighting corresponding approximately to the 40 dB equal loudness curve, that is to say, the human ear's response at low to medium sound levels. It is by far the most commonly applied frequency weighting and is used for all levels of sound.

a_{WCrest}: Crest factor given by $Peak_W/a_W$ over the entire measurement period

a_W: Time-averaged (RMS) weighted acceleration value, averaged over the entire measurement period with frequency weighting W_m or W_{mb}

$a_{W,1s}$ Maximum time-weighted acceleration value during the latest second with frequency weighting W_m or W_{mb} and 1 s exponential time constant

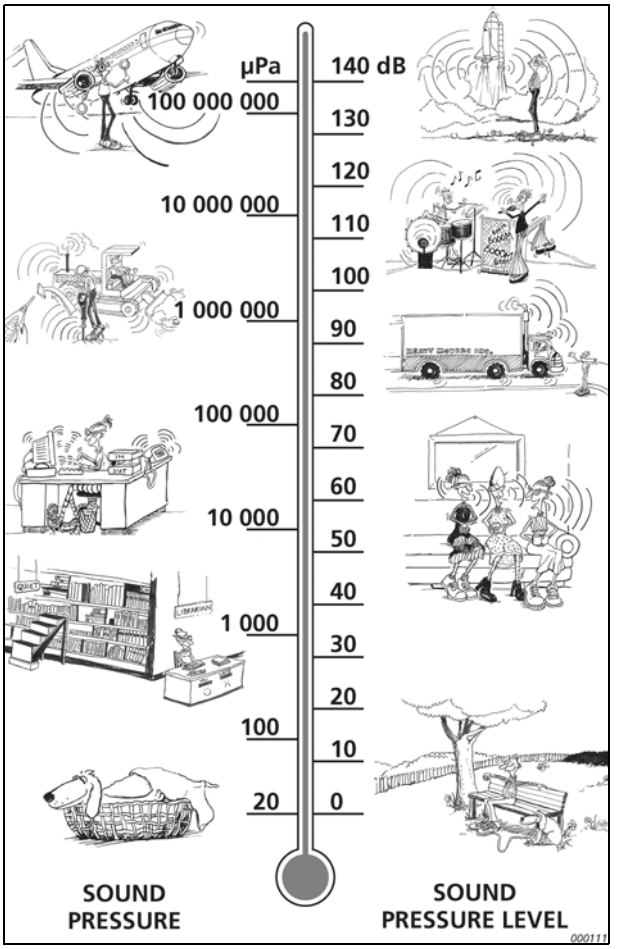
B-weighting filter: Frequency weighting corresponding approximately to the 70 dB equal loudness curve, that is to say, the human ear's response at medium sound levels.

C-weighting filter: Frequency weighting corresponding to the 100 dB equal loudness curve, that is to say, the human ear's response at fairly high sound levels. Mainly used when assessing peak values of high sound pressure levels.

Criterion Level: Criterion Level is the maximum averaged sound level allowed for an 8-hour period. Used for calculation of Dose, ProjDose, DoseUQ and ProjDoseUQ, where U = F or S and Q = 4, 5 or 6 dB.

Decibel (dB): The measurement unit for expressing the relative intensity of sound. A direct application of linear scales (in Pa) to the measurement of sound pressure leads to large and unwieldy numbers. As the ear responds logarithmically rather than linearly to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The advantage of using dB can be clearly seen in the below illustration. Here, the linear scale with its large numbers is converted into a manageable scale from 0 dB at the threshold of hearing (20 μPa) to 130 dB at the threshold of pain (~100 Pa).

Our hearing covers a surprisingly wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable



Dose, ProjDose: The Noise Dose is the equivalent averaged A-weighted Noise Level (taking the Threshold Level into account) using Exchange Rate = 3 for an 8 hour period (reference duration) relative to the maximum allowed (the Criterion Level) – expressed in percentage.
Example: If the Criterion Level is 85 dB and a person is exposed to a constant sound pressure level of 85 dB for 8 hours, then the Dose is 100%. A constant level 88 dB results in a Dose of 200% and a constant level of 82 dB results in a dose of 50%.
The Projected Dose is the Noise Dose based on measurement duration less than 8 hours, assuming the sound level for the remaining time stays the same.

DoseUQ, ProjDoseUQ: The Noise Dose is the averaged A-weighted Noise Level (taking the Threshold Level into account) with Time Weighting U = F or S and Exchange Rate Q = 4, 5 or 6 for an 8 hour period (reference duration) relative to the maximum allowed (the Criterion Level) – expressed in percentage.
Example: If the Criterion Level is 90 dB and a person is exposed to a constant average sound level of 90 dB for 8 hours with Time Weighting S and Exchange Rate 5, then the DoseS5 is 100%. A constant level 95 dB results in a DoseS5 of 200% and a constant level of 85 dB results in a doseS5 of 50%.
The Projected DoseS5 is the Noise DoseS5 based on measurement duration less than 8 hours, assuming the sound level for the remaining time stays the same.

E: Sound Exposure is the energy of the A-weighted sound calculated over the measurement time. The unit is Pa^2h.

Exchange Rate: Exchange Rate is the increase in noise level that corresponds to a doubling of the noise level. The Exchange Rate is used for calculation of L_{avUQ}, TWA, TWA_v, DoseUQ and ProjDoseUQ, where U = F or S and Q = Exchange Rate: 4, 5 or 6 dB.
Note: L_{Aeq} is always based on an Exchange Rate = 3.

Exposure Time: Exposure Time is the actual time that a person is exposed to noise during a workday. Used for calculation of $L_{ep,d}$ and $L_{ep,d,v}$.

Fast Max: Maximum time-weighted acceleration or voltage level measured with Linear frequency weighting and Fast time weighting. It is the highest level occurring during the measurement time.

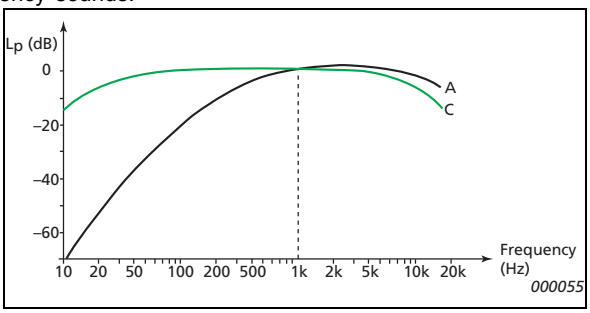
Fast Min: Minimum time-weighted acceleration or voltage level measured with Linear frequency weighting and Fast time weighting. It is the lowest level occurring during the measurement time.

'F', 'S' or 'I' time weighting: A time weighting (sometimes called a 'time constant') defines how the exponential averaging in root-mean-square (RMS) measurement is done. It defines how the heavily fluctuating sound pressure variations are smoothed or averaged to allow useful readings. The standards define three time weightings: F (Fast), S (Slow) and I (Impulse). Most measurements are carried out using the 'F' time weighting, which uses a 125 ms time constant.

Frequency: The number of pressure variations per second. Frequency is measured in hertz (Hz). The normal hearing for a healthy young person ranges from approximately 20 Hz to 20000 Hz (20 kHz).

Frequency weighting: Our hearing is less sensitive at very low and very high frequencies. In order to account for this, weighting filters can be applied when measuring sound. The most commonly used weighting is the 'A-weighting', which approximates the human ear's response to low – medium noise levels.

Frequency weighting (cont.): A 'C-weighting' curve is also used, particularly when evaluating very loud or low-frequency sounds.



G-weighting: Frequency weighting used for infrasound measurements.

KBF: Instantaneous time-averaged acceleration level with Wm weighting and with 125 ms exponential time constant.
Note: W_m weighting of the acceleration signal corresponds to using H_{KB} weighting on the velocity signal, as defined in DIN 45669–1.

KBF_{max}: Maximum of the KBF values

KBF_{Tm}: Average of the values of KBF_{maxi}, where each KBF_{maxi} has been measured during 30 s.

L_{AE}: Sound Exposure Level – sometimes abbreviated SEL and sometimes called Single Event Level, is the Sound Exposure expressed as a level. The letter 'A' denotes that the A-weighting has been included.

L_{Aeq}: A widely used noise parameter that calculates a constant level of noise with the same energy content as the varying acoustic noise signal being measured. The letter 'A' denotes that the A-weighting has been included and 'eq' indicates that an equivalent level has been calculated. Hence, L_{Aeq} is the A-weighted equivalent continuous noise level.

$L_{Xeq,T,mov}$ and $\Delta L_{eq,T,mov}$: Moving (or sliding) X-weighted average (equivalent continuous noise level) for the latest T minutes. Updated every second during measurement. The parameter can be used to monitor the average noise level within T minutes, for example, to monitor that the noise level during a music event doesn't exceed a certain limit at any 15 minutes of observation time during the event. The value is equal to L_{Xeq} at the start of the measurement as long as the elapsed time less than or equal to T. Two values with frequency weighting X = A and C are measured simultaneously. $\Delta L_{eq,T,mov}$ is calculated as the difference between $L_{Ceq,T,mov}$ and $L_{Aeq,T,mov}$

$L_{Xeq,T,mov,max}$ and $\Delta L_{eq,T,mov,max}$: The maximum of the $L_{Xeq,T,mov}$ values during the measurement, only taking values into account where elapsed time is greater than or equal to T. Two values with frequency weighting X = A and C are measured simultaneously. $\Delta L_{eq,T,mov,max}$ is calculated as the difference between $L_{Ceq,T,mov,max}$ and $L_{Aeq,T,mov,max}$

L_{AF}: The instantaneous time-weighted sound level, Lp, is available at any time. 'A' denotes that the A-frequency weighting is used. 'F' denotes that the Fast time-weighting is used.

L_{AFmax}: Maximum time-weighted sound level measured with A-frequency weighting and Fast time weighting. It is the highest level of environmental noise occurring during the measurement time. It is often used in conjunction with another noise parameter (for example L_{Aeq}) to ensure a single noise event does not exceed a limit.

L_{AFmin}: Minimum time-weighted sound level measured with A-frequency weighting and Fast time weighting. It is the lowest level of environmental noise occurring during the measurement time (time resolution is 1 s).

$L_{AF90.0}$: The noise level exceeded for 90% of the measurement period with A-frequency weighting and Fast time weighting. The level is based on statistical analysis of a parameter (LAF or LAS) sampled at 10 ms intervals into 0.2 dB wide classes. The percentage is user-definable.
An analysis of the statistical distributions of sound levels is a useful tool when assessing noise. The analysis not only provides useful information about the variability of noise levels, but is also prominent in many standards as the basis for assessing background noise. For example, L_{AF90} is used as an indicator of background noise levels while L_{AF10} or L_{AF5} are sometimes used to indicate the level of noise events.

$L_{A90.0}$: The noise level exceeded for 90% of the measurement period with A-frequency weighting. The level is based on statistical analysis of L_{Aeq} sampled at 1 s intervals into 0.2 dB wide classes. The percentage is user-definable.

$L_{AF(SPL)}$: The Sound Pressure Level (maximum time-weighted sound level during the latest second) is available at any time. 'A' denotes that the A frequency weighting is used. 'F' denotes that the Fast time-weighting is used.

L_{AFTeq}: Taktmaximal Mittelungspegel as defined by DIN 45641. L_{AFTeq} has also been called L_{AFTm5} or L_{ATm5F}.

L_{avUQ}: Average Sound Level with Time Weighting U = F or S and Exchange Rate Q = 4, 5 or 6. This is a widely used occupational health noise parameter in the USA, corresponding to the L_{Aeq} used otherwise.

L_{Cpeak}: Maximum peak sound level during a measurement. 'C' denotes that the C frequency weighting is used. Used for assessing possible damages to human hearing caused by very high short-duration noise levels.

$L_{Cpeak,1s}$: Maximum peak sound level during the latest second – is available at any time. 'C' denotes that the C frequency weighting is used. Used for monitoring the peak levels.

L_{den}, L_{day}, $L_{evening}$, L_{night}, L_n: Noise Indicators for describing the annoyance due to exposure to environmental noise.
L_{den} (day-evening-night noise indicator), L_{day} (day-noise indicator), $L_{evening}$ (evening-noise indicator) and L_{night} (night-noise indicator) are defined by the European Union. They are based on L_{Aeq} over different periods: L_{day} over the day period from 7:00 to 19:00, $L_{evening}$ over the evening period from 19:00 to 23:00, L_{night} over the night period from 23:00 to 7:00 and L_{den} over the whole day with a penalty of 5 dB(A) for the evening period and a penalty of 10 dB(A) for the night period.
L_{dn} (day-night level) is defined by the Environmental Protection Agency (EPA) in the USA as a descriptor of noise level based on L_{Aeq} over the whole day with a penalty of 10 dB(A) for night time noise (from 22:00 to 7.00).

$L_{ep,d}$: The Daily Noise Exposure Level is the average A-weighted noise exposure level for a nominal 8-hour working day. $L_{ep,d}$ is also known as $L_{EX,8h}$. $L_{ep,d}$ is calculated from the measured L_{AE}, the setting of Exposure Time and a Reference time of 8 h. Used for assessing the noise exposed to a worker during a working day – in accordance with ISO standards.
The European Noise at Work Directive 2003/10/EC defines the following limit and action values:
Exposure Limit Value: 87 dB
Upper Exposure Action Value: 85 dB
Lower Exposure Action Value: 80 dB.

$L_{ep,d,v}$: The Daily Noise Exposure Level for a user-defined reference period. $L_{ep,d,v}$ is calculated from the measured L_{AE} and the settings of Exposure Time and Reference Time. Used, for example, for calculating a Weekly Noise Exposure Level, by setting the Reference Time to 40 h.

Loudness, Loudness Level: Loudness is the subjective judgement of intensity of a sound by humans. Loudness depends upon the sound pressure and frequency of the stimulus and whether the sound field is diffuse- or free-field. The unit is the Sone. Loudness Level = 10*log2(Loudness) + 40. The unit is the Phone.
The Zwicker method of calculation of stationary loudness based on 1/3-octave measurements is described in ISO 532 -1975, Method B.

Linear Weighting: 'Linear' frequency weighting is without any frequency weighting, that is, equivalent to LIN, Z or FLAT.

Linear: Time-averaged (RMS) weighted acceleration (or voltage) value, averaged over the entire measurement period with frequency weighting Linear

L_{Geq}: The G-weighted equivalent continuous noise level – used to assess infrasound

L_{Gpeak}: Maximum peak sound level with G-weighting

L_{G10}: Instantaneous time-weighted sound level with G-weighting and 10 s exponential time constant

L_{G10max}: Maximum time-weighted sound level measured with G-weighting and 10 s exponential time constant

L_{G10min}: Minimum time-weighted sound level measured with G-weighting and 10 s exponential time constant

L_W: a_W expressed in dB with reference 10^{-6} m/s^2.

MTVV Maximum of the $a_{W,1s}$ values

#CPeaks(>140dB): The number of 1 s peak sound levels over 140 dB. 'C' denotes that the C frequency weighting is used.
Three peak counters are available – one with a user-definable value (set to 140 dB by default), one with 137 dB and one with 135 dB value. Used for assessing possible damage to human hearing caused by very high, short-duration, noise levels.
The European Noise at Work Directive 2003/10/EC defines the following limit and action values:
Limit Value: 140 dB corresponding to 200 Pa
Upper Action Value: 137 dB corresponding to 140 Pa
Lower Action Value: 135 dB corresponding to 112 Pa.

NC, NC Decisive Band: Noise Criteria is used to rate steady-state continuous noise in a room from all types of equipment, including fans, mixing boxes, diffusers, etc.
The rating is determined from 1/1-octave L_{Zeq} spectra compared with NC curves (based on equal loudness curves). The NC rating is the value of the rating curve that falls entirely above the measured data. The Decisive Band is the frequency band 'touching' the NC curve.
Defined in ANSI 12.2–2008

NCB, NCB Classification, Rumble, Hiss, RV: Balanced Noise Criteria is a refinement of NC.
The rating is determined by the SIL value and gets the Classification (R) for Rumble, if the spectrum is rich in low frequency sound (16 Hz to 500 Hz), the Classification (H) for Hiss, if the spectrum is rich in high frequency sound (1 kHz to 8 kHz), or the Classification (RV) for Vibration and Rattle if the spectrum at low frequencies (16 Hz to 63 Hz) is likely to produce audible rattling in lightweight building elements.
The details of the NCB rating are defined in ANSI S12.2-1995

NR, NR Decisive Band: Noise Rating rates noise levels at public or private indoor areas.
The rating is determined from 1/1-octave L_{Zeq} spectra compared with NR curves (based on equal loudness curves). The NR rating is the value of the highest NR curve 'touched' by the measured spectrum. The Decisive Band is the frequency band 'touching' the NR curve.
Defined in ISO R1996(1971)

Occupational Health Standards: Typical Setup Parameter settings for Occupational Health measurements in accordance with various standards:

- OSHA (Occupational Safety and Health Administration) – 29 CFR 1910.95
- MSHA (Mine Safety and Health Administration) – 30 CFR 62.0 UMHRPEL
- DOD (Department of Defence) – DoD Instruction 6055.12
- ACGIH (American Conference of Government Industrial Hygienists) – DHHS Pub 98-126
- ISO – UK Noise at Work Regulations SI 1989/1790 amended by SI 1992/2966 and SI 1996/341

See the table below, but please also check your local legislation.

Table E.1 *Occupational Health Setup Parameters and Associated Standards*

Setup Parameters	OSHA	MSHA	DOD	ACGIH	ISO
Broadband (excl. Peak)	A	A	A	A	A
Broadband Peak	Z	Z	Z	Z	C
Exposure Time	N/A	N/A	N/A	8:00:00	8:00:00
Reference Time (Preset)	8:00:00	8:00:00	8:00:00	8:00:00	8:00:00
Reference Time (user-definable)	40:00:00	40:00:00	40:00:00	40:00:00	40:00:00
Threshold Level	80	80	80	80	70

Table E.1 *Occupational Health Setup Parameters and Associated Standards*

Setup Parameters	OSHA	MSHA	DOD	ACGIH	ISO
Criterion Level	90	90	85	85	85, 90
PeaksOver Level[*]	140	140	140	140	140
Exchange Rate for Lav	5	5	4	N/A	N/A
Weighting for Lav	S	S	S	N/A	N/A

*. This is user-definable – the two other 'PeaksOver Level' parameters are preset to 137 and 135 dB resp.

Peak Maximum peak of the acceleration signal or voltage input with frequency weighting Linear

$Peak_W$ Maximum peak of the acceleration value with frequency weighting W_m or W_{mb}

Reference Time: Reference Time is used for calculation of Sound Exposure Level $L_{ep,d,v}$ or Time Weighed Average TWA_v with a reference time other than 8 hours.

RC, RC Classification: The Room Criterion Mark II is primarily a diagnostic tool for HVAC noise in spaces.
The RC curve is chosen as the value of the PSIL, rounded to the nearest integer, in the range $25 \leq RC \leq 50$.
The RC classification is the combination of the Sound Quality Descriptor and the Probable Occupant Evaluation.
The sound quality descriptor can display the values (N) for neutral, where no frequency range is dominant; (LF) for rumble, where the low-frequency range (16 – 63 Hz) is dominant; (MF) for roar, where the mid-frequency range (125 – 500 Hz) is dominant; and (HF) for hiss, where the high-frequency range (1000 – 4000 Hz) is dominant. Furthermore, there are two variations of (LF) if the spectrum in the low-frequency range is likely to introduce vibrations: (LFVA), where there are clearly perceptible vibrations and (LFVB), where there are moderately perceptible vibrations.
The probable occupant evaluation describes how an occupant responds to a spectrum and can have the values *Acceptable*, *Marginal* or *Objectionable*.
Described in the ASHRAE Handbook – HVAC 2011 and ANSI 12.2–2008.
Room Criteria is for rating room noise

SIL, PSIL, SIL3: SIL (Speech Interference Level) is the arithmetic average of the 500 Hz, 1 kHz, 2 kHz and 4 kHz octave band levels.
PSIL (Preferred Speech Interference Level) is the arithmetic average of the 500 Hz, 1 kHz and 2 kHz octave band levels.
Used for evaluating the interference of noise upon speech communication.
SIL3 (Speech Interference Level based on highest 3 octaves) is the arithmetic average of the 1 kHz, 2 kHz and 4 kHz octave band levels.
Note: Though SIL, PSIL and SIL3 are defined for octave band levels they are also calculated for 1/3-octave band levels by summing the power values in the three bands within each octave before doing the averaging.

Slow Max Maximum time-weighted acceleration or voltage level measured with Linear frequency weighting and Slow time weighting. It is the highest level occurring during the measurement time.

Slow Min Minimum time-weighted acceleration or voltage level measured with Linear frequency weighting and Slow time weighting. It is the lowest level occurring during the measurement time.

Sound: Any pressure variation that the human ear can detect. Just like dominoes, a wave motion is set off when an element sets the nearest particle of air into motion. This motion gradually spreads to adjacent air particles further away from the source. Depending on the medium, sound extends and affects a greater area (propagates) at different speeds. In air, sound propagates at a speed of approximately 340 m/s. In liquids and solids, the propagation velocity is greater – 1500 m/s in water and 5000 m/s in steel.

Sound level or sound pressure level: The level in decibels of the pressure variation of a sound. See also **decibel**.

Std.Dev. The Std.Dev. is calculated as the Standard Deviation of the noise samples used for statistics. This is either L_{AF} or L_{AS} sampled every 10 ms, or L_{Aeq} sampled every second.

T_{Cpeak}: The time when the peak sound level occurred. 'C' denotes that the C frequency weighting is used.

Threshold Level: Any sound levels below the threshold level do not contribute to the Dose measurement data. For example, if you set the threshold level to 80, any sound levels below 80 dB are not taking into consideration by the analyzer, when it calculates doses and time weighted averages.
Used for calculation of Dose, ProjDose, TWA, TWA_V DoseSQ, ProjDoseSQ.

TWA: The Time Weighted Average is the average A-weighted sound level for a nominal 8-hour working day with Time Weighting S and Exchange Rate 5. TWA is calculated from the measured LavS5 (taking Threshold Level into account) and a Reference time of 8 h. Mainly used in the USA for assessing the noise exposure for a worker during a working day.

TWA_V: The Time Weighted Average for a user-defined reference period. TWA_V is calculated from the measured LavS5 (taking Threshold Level into account) and the Reference Time. Used, for example, for calculating a Weekly Time Averaged Level by setting the Reference Time to 40 h.

Underrange

Immediate underrange indicates that the broadband sound level is below the lower limit of the Linear Operating Range and is indicated separately for the two selectable frequency weightings and for the two channels (Type 2270 only).
Immediate underrange is only indicated on the screen. No underrange information is saved with the final result of the measurement.
In case of an underrange indication (2-channel measurements, High Range only), change to Low Range.
The underrange indication is implemented as required by ISO 61672–1:2013 and does not account for the influence of self-generated noise from the microphone because the specifications for the lower limit of the Linear Operating Range apply for measurements of electrical signal inserted into the preamplifier through the applicable input device. This makes the underrange indication a dubious indicator of the quality of the measurement, especially on the more sensitive ranges.
Example 1: *Und. A* – Immediate underrange for the A-weighted levels
Example 2: U1 AC – Immediate underrange in channel 1 for the A- and C-weighted levels

W_m

Frequency weighting as defined in ISO 8041:2005 – used for whole-body vibration in buildings, all directions

W_{mb}

The band-limiting part of the W_m filter

Z-weighting:

'Zero' frequency weighting is without any frequency weighting, that is, equivalent to Linear, LIN or FLAT.

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